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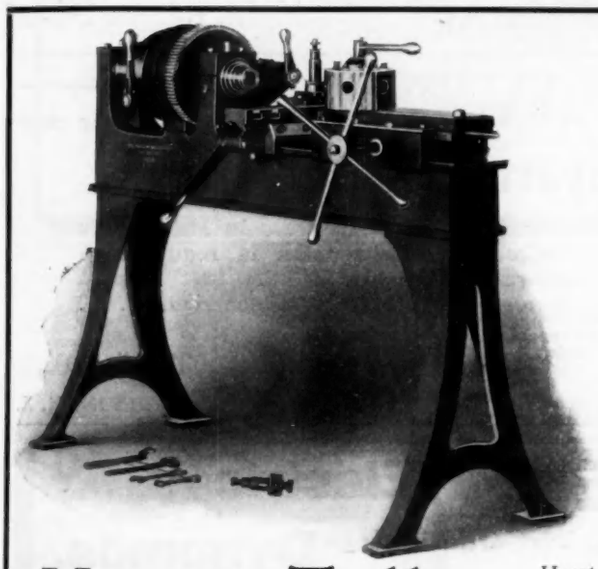

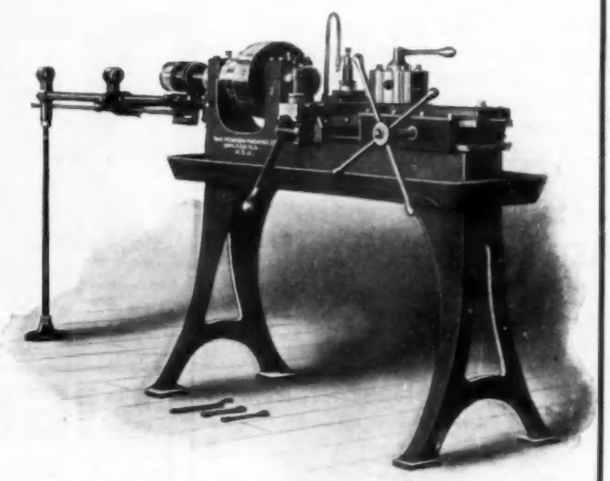

Money Talks.

Heretofore a purchaser of screw or turret machines was, in many cases, "between the devil and the deep sea." He must select a machine **built** well enough to produce accurate work continuously, **designed** so as to be handy and convenient for the operator, **proportioned** for long life and freedom from accidents, **powerful** enough to work up to its full rated capacity and **CHEAP** enough to suit the man who pays the bills.

He need hesitate no longer. We have combined all of these points in one machine. We build it in all combinations and many sizes. You are **wasting your money** by buying before investigating our machine and getting our prices.

WASTE NOT, WANT NOT. They say that "a word to the wise is sufficient." Is it? Are you wise? Then send for our Catalog.

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Cable: "Pearson, Chicago." Lieber's Code.

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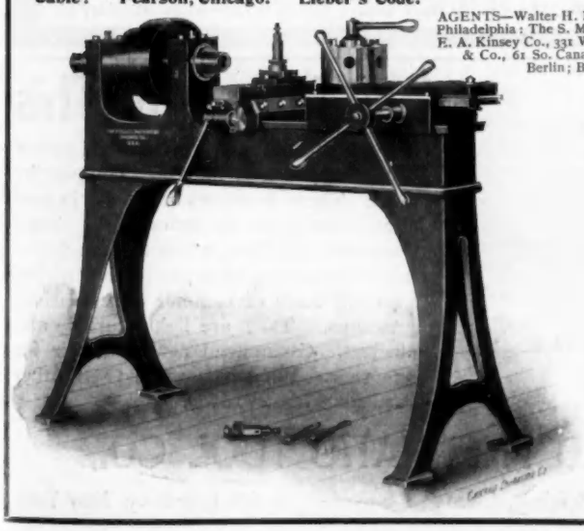

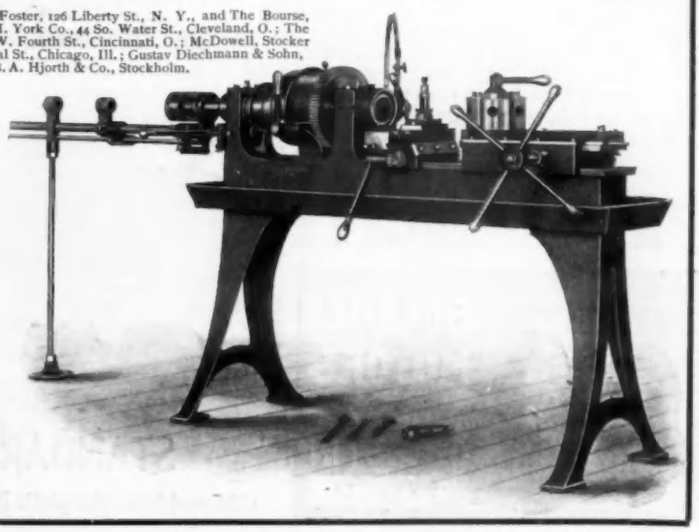

Oil Economy

doesn't lie in the use of one drop where two are needed, nor in the use of the cheapest oil. Neither of these would be economy. Real economy in the use of oil lies in using good oil and using it over and over until its goodness is gone. How can you use it over and over? By the use of a Roper Centrifugal Oil Separator, which separates oil from bolts, nuts and scraps of all sorts.

There's nothing experimental about this method of reclaiming oil—it passed that stage about seventeen years ago, and is now proving its usefulness in the best machine shops in the country.

You can't afford to be without a Roper Separator if you use as little as three barrels of oil per year. Send for full particulars.

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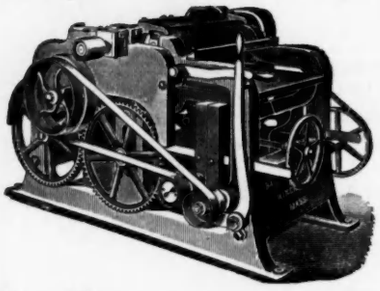
LEADING MAKERS OF SUGAR MACHINERY.

Founded 1845. Incorporated 1864. **Boston, Mass.**



The Planer that does

the business is Whitney's P-4 Planer. It's the Planer that's doing all the particular planing in a great many of the best wood-working establishments in the world, and that's doing more and more of it each year. It's the only Planer we know of that will plane stuff that's less than three inches long without clipping the ends.

Tell us what you'd like to know about it.

Baxter D. Whitney,

Winchendon, Mass.

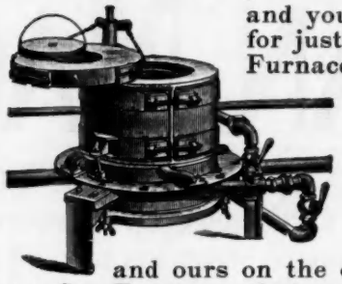
UNIVERSAL — BULLOCK ELECTRIC MF'G CO. — ELECTRIC — CINCINNATI, O. U.S.A. — SYSTEMS.

BULLOCK MOTORS

SEND FOR BULLETIN No. 0232.

83

We Can't Help You If You Won't Let Us,

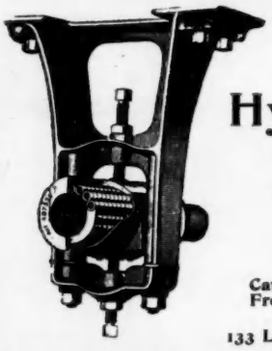


and you lose more than we if you don't let us, for just this reason: We lose the sale of a Gas Furnace or two; you lose every cent of the difference between the cost of operating the old, dirty, time-wasting coal or coke furnace and our Gas Furnace, for years to come, and that will run up into dollars pretty fast.

If you're at all interested, just write your address on one side of a postal and ours on the other, and we'll send you a book about our Gas Furnaces, that ought to lead to your saving some money if you read and consider its contents.

AMERICAN GAS FURNACE CO., 23 John St., New York.

Chas. Churchill & Co., London, Birmingham and Glasgow. Schuchardt & Schütte, Berlin, Cologne, Vienna St. Petersburg. H. Glaenzer & Perreaud, Paris.



WHEN YOU ORDER BELTING Remember that

Hyatt Roller Bearings

save belting. The stress in starting is decreased, less tension is required in operation, the life of the belt is prolonged and power is economized. . . . .

Catalog is Free. . . . **Hyatt Roller Bearing Co.,**

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Meters, Etc., Etc.

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One Man With This

No. 3 "Little Giant" Pneumatic Hammer can do the work of four men chipping by hand. These hammers are made in four sizes, covering all classes of work. They have an air regulator, adjustable to admit a minimum amount of air, and deliver a blow with full force of hammer under various pressures. They are light, durable and efficient. Guaranteed against repair for one year. Want one on trial? Further particulars of . . . .

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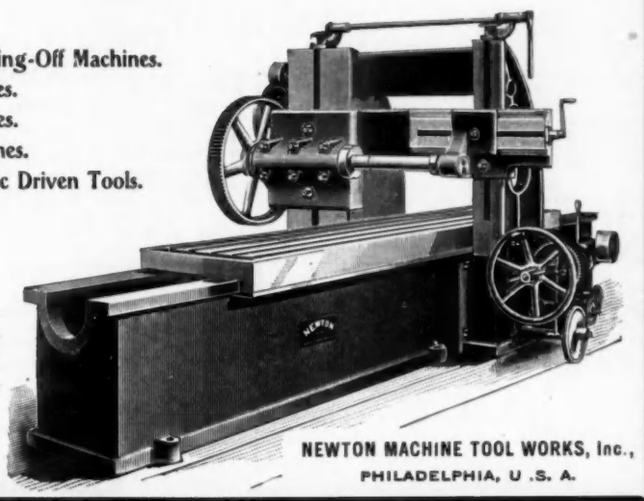
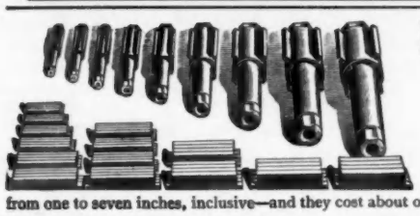
Cold Saw Cutting-Off Machines.
Milling Machines.
Boring Machines.
Slotting Machines.
Portable Electric Driven Tools.



Eight sizes plain milling machines 15 in. x 15 in. to 72 in. x 72 in., any desired length of carriage.

NEWTON MACHINE TOOL WORKS, Inc.,
PHILADELPHIA, U .S. A.



It Is Practically Impossible

to have solid arbors for all sizes of holes. It would require a great deal of room to store them, and the cost would be all out of proportion to the possible benefits. The Nicholson Expanding Mandrels solve the problem. Nine of them will take the place of a great many times as many solid arbors—covering every size of hole, from one to seven inches, inclusive—and they cost about one-quarter as much. Ready for delivery now. Catalog free.

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Brass Foundry and Coppersmith Shop, and want to build machines or parts of same, by contract, or furnish first-class Brass Castings.

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Keep Boilers Clean and Free from Scale. Guaranteed.

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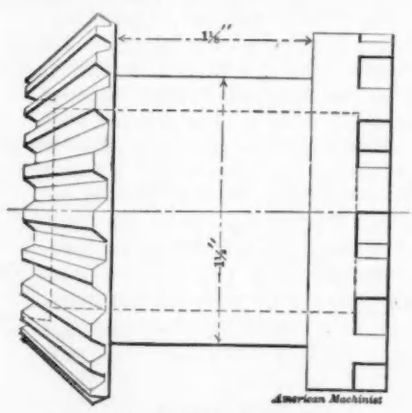
OH, YES; YOU CAN DO IT ON A LATHE



Hardened steel finished. Sides and bottom. 5 minutes

if you've lots of time and don't mind whether it's done accurately or not. But it will make you awfully tired to try to make two of them just alike, on any lathe you ever saw.

No use talking, there's no lathe on earth that will do grinder work as a good grinder will do it—as the LANDIS GRINDER will do it—'tisn't to be expected.

We've a 94-page book that's chock full of information about Landis Grinders, and we'll send you a copy if you'll say you want it.

LANDIS TOOL CO.,

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Hill, Clarke & Co., Boston and Chicago. Walter H. Foster, Manager, New York. C. W. Burton, Griffiths & Co., London. Ad. Janssens, Paris and Brussels. Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm and St. Petersburg.

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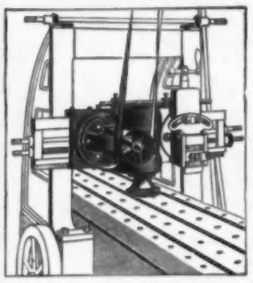

combined with any

Iron Planer

swivels from Horizontal to Vertical.

Do not plane surfaces that should be milled or mill surfaces that should be planed.

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The Fellows Gear Shaper Co.,

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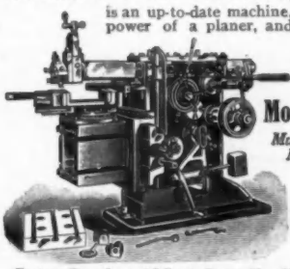
is an up-to-date machine, with the cutting power of a planer, and has unequaled capacity for true and rapid work. Sizes from 20 to 48 inch stroke.



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JOHN A. HILL, President and Treasurer.
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FRED J. MILLER, Chief.

FRANK RICHARDS,
F. A. HALSEY,
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Effect of the Rush on Quality of Tools.

In another part of this issue we publish a communication from a London correspondent, calling attention to a matter of some importance to our machine tool builders, and especially to their foreign trade. It would, of course, be a grave mistake to infer from this article that all, or even a large proportion, of American tools have seriously deteriorated in quality recently.

It is a familiar fact that machine shops seldom are able to do quite as good work when they are rushed as when orders are not so pressing, however good the intentions of their managers may be in this respect. When times are rushing men must be employed on work which they would not be considered fit to do in ordinary times, and many men must work overtime by artificial light and under conditions which do not permit them to turn out their best work. Some shops have their work so systematized that these influences do not produce serious deterioration, but by no means all of them have; and then there are the shops in which the mechanical side of the business is entirely subordinated to the commercial side, in which, apparently, the fact that the building of machine tools is a mechanical business is entirely overlooked and the untrammelled ideas of "business men" and "hustlers" reign supreme. No good tools can be expected from such shops at any time, and during a rush, when they know that the more they can crowd production the more money there is to be made, they, of course, crowd things to the uttermost limit, and all hands let quality go hang.

Of course, this is to be regretted, but there is probably no help for it. A real mechanic will do his work properly at all times, simply because he recognizes but one way to do work; the botch will never do it better than circumstances compel him, and foreign buyers of machine tools must learn, as American buyers of them have, that there is almost, though probably not quite, as much difference between different American tools as between different English tools, and they must discriminate, and learn not to howl about the shortcomings of "Yankee tools" as a whole because they find imperfections in a few of them. It would be about as reasonable for Americans to condemn all British tools on the strength of a trial of the cheapest Yorkshire lathe, or all French tools because of the uncouth ugliness and general worthlessness of a tool made near the Belgian frontier.

When the present writer visited England two years ago he repeatedly encountered shop managers who criticised American tools on the basis of their experience with our most inferior makes, and some of them seemed actually to believe that they had as good as any, if not the best of our tools. Only experience will teach them better, and this is the way in which reputations, good and bad, will be built up abroad—reputations which will be of value or the reverse when times are not so rushing as they are now.

Finally, all this is an argument in favor of the course we have always recommended, of buying tools, so far as possible, when times are dull. At such times not only are prices lower, but good workmanship is more to be expected and can much more readily be enforced, because then there is time enough to do it; tools are not needed so urgently and builders generally are a little more solicitous.

The Supply of Mechanics for the Next Generation.

In a recent installment of his series of articles on "Machine Shop Management in Europe and America," published in the "Engineering Magazine," Mr. H. F. L. Orcott asks if the advantages, which he owns American shops now enjoy, are likely to be permanent, and he answers his own question in the negative. His reason for thus answering the question lies in the increased specialization of American shops, with the tendency which accompanies this specialization to train up boys to be mere machine tenders or operatives instead of mechanics in the proper sense of that term. In other words, Mr. Orcott believes that the very system which has given us our present position will in the end, by a process of reaction, destroy the very thing which it has created. He considers that the present American system of manufacture is the outgrowth of the conditions which preceded it—social conditions which developed independence of thought and enterprise in action, technical conditions which trained up a body of superior mechanics, and economic conditions which gave to this combination of enterprise and skill full play in business development; the result being what we see about us. There is no reader of the "American Machinist" who cannot count up a goodly number of men who now occupy the front rank in a business sense and who began life in the shop earning their daily bread. It is no uncommon thing to hear men who occupy positions which anyone might envy speak of the time when and place where they "served their time." It is such men as these who have laid the foundations and built the superstructure of American manufactures, and they form one of the glories of America. Mr. Orcott evidently does not consider that the conditions which have produced this race of men now exist. Nor, going down the scale, does he consider that under present conditions are successors being trained to the lieutenants and privates without whose aid the efforts of the leaders would have been comparatively fruitless. In other words, he does not believe that the present condition of things is self-perpetuating. We are, so to speak, in his opinion, in the condition of a man who is living on his capital which was accumulated by the generations before him.

Mr. Orcott is not the only one who holds these pessimistic views. Reading

between the lines of Professor Sweet's Rochester address, published in our last week's issue, it is hazarding little to surmise that the professor holds similar views.

There is already a marked deficiency in the supply of foremanship talent. We frequently hear of openings of this kind which fairly gape to find an occupant. As industries develop and become more highly organized, a higher grade of talent in these positions becomes necessary for them; but, on the other hand, this very process of development on more highly organized lines tends to restrict the growth of the very qualities for which it sets an increasing demand.

The world is full of failures of one generation to anticipate or to attempt to solve the problems of the next. One may be convinced of the truth of these opinions and at the same time be optimistic as to the ultimate outcome. The great forces of industrial and social progress are almost as much beyond the control of man as the forces of physical nature, and for ourselves, even granting the situation to be as described, we do not fear the outcome or believe it will be what strict logic may indicate. There is such a thing as carrying logic too far. We all know men who are so minutely logical as to become in the end illogical. Nothing, in fact, is so unsafe as the application of the strict rules of logic to diverse and uncertain premises, whose relative importance and bearing upon one another cannot be known.

How the situation will or should be met we do not profess to know. Professor Sweet obviously believes the correct solution to lie in the trade school. We have no shadow of doubt that a trade school conducted on the lines laid down by him—such a school, in fact, as he might conduct—would successfully train competent mechanics. Nay more, we believe it would train better mechanics than even the old system, except in exceptional cases, like that of the professor himself; for few apprentices, even in the palmy days of apprenticeship, had as good and capable a "boss" as he. We very much doubt, however, the advisability of the establishment of such schools by State aid. This, not because such use of State funds is improper, for we regard it as eminently proper, but because State schools of this kind would be part of the educational system of the State, and as such would be controlled by those who have been bred in the present scholastic atmosphere. The inevitable result would be the assimilation of the work of the trade schools with that of the present educational system. The very opposite of this is necessary. The old grooves must be left behind and new ground must be broken if the highest success is to be attained. We could point out at least one great educational experiment which was a flat failure largely because the new idea was made the tail to an old kite.

This whole subject of industrial education is in its infancy, at any rate in this country. By common repute Germany leads in educational development on these lines. We have too little knowledge of the German schools of technology to speak of them with much confidence, and it may or may not be true that they might be transplanted to this country and be found in harmony with the new environment. We in this country have been reared to almost worship the little red school-house as the foundation of our institutions, but it should be plain to all that new conditions demand new treatment and that new wine should be put into new bottles. Despite the orthodox belief to the contrary, the wisdom of the world is not all to be found in its books, and the glorification of education, as that word is commonly understood, may easily be carried altogether too far.

Case Hardening.*

BY JOHN BULKLEY.

The process of case hardening has not changed materially for the past few years. The principal materials used remain the same: granulated rawbone, hydro-carbonated bone black, black oxide of manganese, sal soda, charcoal and salt.

These materials are commonly used in railroad shops, and give much satisfaction if they are carefully and properly handled.

For pins and bushings and such light work as is required for immediate use, we use the "New York Specialty Case Hardening Powder." This we found to be greatly superior to potash. Specimens of same will be found among samples of case hardening submitted here for your inspection.

The work which is to be hardened can be packed in cast or wrought iron boxes, sealing with fire clay or mud, so as to prevent the gases from escaping as much as possible. The pieces to be hardened should be placed about 2 inches apart in box. The vacant spaces are well filled and packed with the material you are using for case-hardening purposes. Should your box be supplied with heavy work, as crank pins, guides, etc., 15 to 20 hours of steady heat is necessary in order to secure best results. If, on the other hand, you have light pieces, as links, link-blocks and pins, 8 to 10 hours will be sufficient to subject them to a good heat.

This class of work we place in the furnace about 8 o'clock of a morning, and heat it all day. At night close up the furnace, letting the box remain over night and remove next morning. Reheat this work and cool in cold water.

We have secured good results using granulated raw bone.

If using hydro-carbonated bone black, pack pieces in box and seal same as before given.

Furnaces for case hardening should be so constructed that boxes would not have to be raised or lowered while being put into or taken from the furnace. The heating space is near the ground. The fire-box and ash pan are below the surface.

This refers to a furnace heated with soft coal. If the furnace is on outside of a building a stack or chimney, about 16 feet high, will furnish draft enough to heat boxes without aid of blast.

Case-hardening furnaces which are heated with fuel oil are of a very different construction, the boxes being generally heated from the top; with coal, in most cases, it is from the bottom.

The cooling tub is arranged so as to admit cold water from the end near the bottom, the cold stream thus running lengthwise along the bottom of tub.

The cold stream forces the hot water to flow over top of tub.

When cooling, guides, or long pieces, strips or bars of iron should be laid in the bottom of tub, in order to keep the work about 2 or 3 inches from the bottom of tub; in this way the cold stream flows under the work which is being cooled.

* Report of Committee on Case Hardening, submitted to the annual convention of National Railroad Master Blacksmiths' Association, Milwaukee, 1899.

Tuyere Area and Arrangement—A Correction.

A foreign correspondent calls our attention to Mr. L. C. Jewett's article on "Cupola Design and Capacity," published in our issue for May 4 last, and refers to the statement that "the combined area of the tuyeres should be at least 25 per cent. greater than the area of the cupola." This does not agree with the sizes of tuyeres shown, and is, of course, an obvious error. We have referred the matter to Mr. Jewett, who says he intended to say that the combined area of the tuyeres should be 25 per cent. greater than the area of the blow or wind pipe. The sketch published with the original article did not show a blast pipe, and was intended to show a good arrangement of tuyeres to lessen the danger of iron running into them, and to facilitate removal if it did get in, rather than sizes as related to the blast pipe.

A true story is told of a man who had a good stream of water running through his farm, and having heard of the wonders of a turbine water wheel, concluded to build him a mill. Having a nice level place by the creek, he built the mill. Finding out how much power he wanted and consulting the catalog, he found that a certain size wheel at 22 feet head would do the business, and getting the guarantee that the wheel would work just as well under water as above, he proceeded to dig a well 22 feet deep, and put his wheel at the bottom of the well. It wasn't long after that he had a mill for sale and a water wheel to scrap.

Commercial Review.

NEW YORK, FRIDAY EVENING,
September 8, 1899.

MACHINE TOOL MATTERS.

The Fuller Round Bale Compress Company, which controls patents upon machinery for pressing cotton by a much improved process, and has hitherto had its machines constructed by contract, proposes to erect in Memphis, Tenn., a factory to build them for itself. This factory will cost $200,000, and a large proportion of that amount—not unlikely one-half—will go for the machine tool equipment. Inquiries for catalogs have been sent out freely among the trade and specifications for the tools are now being prepared. The list will include many boring mills and milling machines. The machine shop will be 80x265 feet, and the foundry 80x300 feet. The steam plant will probably be of about 500 horse-power, but this is not yet settled. At the factory will be made both compresses and cotton ginning machines.

Mr. Rudolf Kirschbaum, manager of the new Deutsche-Garvin-Maschinen-Fabrik Actiengesellschaft, arrived in New York September 8 by the North German Lloyd steamship line. He was interviewed at the office of the Garvin Machine Company by a representative of the "American Machinist." Mr. Kirschbaum stated that German demand for American tools seems to be about as great still as it has been in the past. Difficulty of obtaining tools for early delivery has retarded business considerably in the heavy lines, but in the lighter ones Mr. Kirschbaum is of opinion that there is an overstock in the hands of German dealers. He holds that the buying boom has been rather between the manufacturer and the German dealer than with the consumer.

Mr. Kirschbaum was asked in particular what the effect of American price advances has been upon the German buyer. He did not appear to lay great stress upon the matter and did not consider that any material effect has yet been felt. He believes, however, that a hesitation of trade from this cause will be natural if buyers think that there is likelihood of prices reacting, but if they find in course of time that values seem permanent they will go ahead and buy wherever they can do so advantageously.

The famine for castings is not felt in Germany as it is here, Mr. Kirschbaum states.

His opinion upon the Russian tool market being requested, he remarked that it had a bright future, but that it is yet in an early stage.

Ground has been broken for the factory of the new company. While the machine tool equipment is being purchased in this country, it is not probable that the electrical plant will be.

DYNAMOS AND MOTORS.

A sign of the vitality of this year's market is its susceptibility to stimulating influences. Already sellers are beginning to talk about fall trade having set in. Business has been so good all through the season that there is little chance for contrast, but indications are for an active autumn.

There is quite a good deal of lighting work now being contracted for. This is the natural season for it, because preparations are being made for the long winter evenings. In New York the office-building industry seems to be fairly active from the view-point of the lighting people. We understand that there are some six or eight of these structures going up, which will put in isolated lighting plants. Contracts have been let for three 50-kilowatt Bullock generators to be installed in the Cheesebrough Building, and for two to go in the Broadway Chambers.

The proprietors of "The Scotsman," Edinburgh, have contracted with the Bullock Electric Manufacturing Company, through their London agents, for four motors on their "Teaser" system to drive the new quadruple presses now being built by R. Hoe & Co., and which will be erected in the new premises under construction for "The Scotsman." Each motor is of 50 horse-power capacity.

Mr. J. S. Neave, vice-president of the Bullock Electric Manufacturing Company, brought back with him from Europe, a fortnight ago, a contract which is the largest the company has ever received, and which is one of the most important electrical export orders of the year. It comes from a big French engineering firm, and calls for a large number of machines, including generators running upward of 400 kilowatts in capacity. The machinery is in great part for railway purposes. It is destined for various places, including Africa, China and Japan. The contract is said to be worth half a million dollars.

An official of one of the largest electric manufacturing corporations stated to-day that its prices had not recently been advanced, nor did he think that they would go higher than they are. Inquiries of several smaller, though representative, companies elicited replies also to the effect that no pronounced increase had been made in several weeks.

Electrical manufacturers who do not have their own foundries are necessarily much hampered still by the difficulty of getting castings. However, a generator of 50 or 100 kilowatts can quite commonly be delivered on two months' notice. The representative of one company says that the trouble in obtaining copper is somewhat relieved.

An electric manufacturing company which caters quite a good deal to the trade of electric vehicle builders is having an active demand from that source, and one feature of the business at present is noteworthy. This is the fact that orders are coming in from a multiplicity of small automobile manufacturers. Some of them are orders for sample machines. Electric vehicle manufacture seems to be becoming a diffused industry, as the bicycle business did a few years ago. The construction of horseless wagons is not to be confined to a few large builders, but is to be competed in by a shoal of smaller fry. This will go on, no doubt, until they find that the competition is being overdone—unless, indeed, the future for automobiles is so vast that there is no possibility of overdoing it. Then a trust will be broached, the big fish will swallow the small ones, and that will be the end of it.

The General Electrical Company is still crowded with a vast accumulation of small orders, as well as some large ones. On generators the company is nine months behind hand. Motors can in many cases be furnished by it on three months' time, though in extreme instances deliveries run up to a year.

CHICAGO MACHINERY MARKET.

A machinery supply representative at Chicago remarked last Saturday that he had just received his first bicycle order for the season. He was gratified thereat, for he had been fearing that the bicycle people were not to be any great buyers this fall and winter. From information he had received he was led to believe that the various companies entering into the new American Bicycle Company combination would to some extent buy individually for the present, as heretofore, whatever the ultimate plans of the company may be.

Trade in machinists' supplies has the monotony of a plateau. No one is complaining about lack of activity, or about low prices, but there is a sameness to the volume of trade that has obliterated seasonal distinctions. Present trade is merely a projection of summer activity along horizontal lines. The trend of values is upward, though there has been no notable appreciation of prices in recent weeks among the numerous small supplies that reach the machinist.

It is quite different with the trade in power transmission machinery. There is, for example, a marked scarcity in shafting, and prices have lately advanced quite rapidly. It is quite difficult to obtain any of the standard sizes of shafting. The reason for this is said to be that mills have assumed large contracts for the special sizes consumed by the agricultural implement people and other large manufacturers, and are running on that class of work to the exclusion of the commercial needs. Orders for shafting have accumulated to the extent of two or three months' deliveries. If there should chance to be a little later in the year an expanding fall trade, and the rule has been for trade to improve about the last of September, there will probably be the liveliest kind of a time in the efforts of users to procure the desired machinery. Makers of hangers, pulleys

and similar goods are running overtime without known exception, and are not gaining on their orders. One prominent maker says he is now four months behind orders and that he can run six months without an additional order, as it would take him two months to stock up.

A great deal of work is going to the mining regions of the West. Makers of mining machinery are unable to keep up with the demand, and are calling upon outside machine shops to help out in the extremity of their needs. One of the Chicago automobile plants is consuming a vast amount of supplies. Cement works throughout the country are large buyers of power transmission machinery. Considerable new work of various kinds is being arranged for. The Chicago Belting Company has just taken an order for 400 feet of 48-inch belting, and another order, for which it is now negotiating, is for 4,000 feet of 18-inch belting.

CINCINNATI REPORT.

Conditions in the manufacture of machinery and metal products have been very different last month from those which characterized previous years. Instead of being marked by the let-up in trade ordinarily felt at that season, the results of investigations indicate that August was a more active month than July. Domestic business is now at a stage unheard of in late years, and manufacturers are pushed to their utmost limit of capacity to meet the demands made upon them. These are the conditions dominant generally in machine tools and other machinery, in electrical and other supplies.

The market, generally speaking, for pig iron was very active during August, and sales much larger in the total amount than those of July. Price was often a small factor; the important matter was to get the iron at any price. Many sales were made for delivery in the first six months of next year, in amounts of 5,000 to 10,000 tons, and now and then orders were taken for larger amounts, up to 20,000 tons. Such sales were made, so far as known, at full prices, or very nearly so. It was reported that some sales were made for delivery in the last half of 1900; these were probably few in number, as the producers are not anxious to accept orders beyond July 1. It is claimed that not any more orders are being accepted for 1899 delivery. There were some cases where parties very anxious to get some iron promptly paid a bonus for it. There are many who have had orders accepted for this year's delivery who will not be able to get them, but the deliveries will run into next year. Manufacturers are so filled up with orders for this year's delivery that only in special cases can quick shipments be hoped for. While some have had, and some are trying to get, orders accepted for delivery in the first few months of next year, there are other consumers who are very conservative in their views as to what the conditions may be in the coming months, and who are anticipating a possible decline after the opening of next year. Where consumers have small stocks on hand the contingency of not being able to get any more when the supply is exhausted has become so practical that the possibility of having to shut down is a matter of serious remark.

The Bethlehem Steel Company's local office is contending with an immense demand for heavy steel shafting and other products in its line, and is more than busy in caring for the very many orders coming in.

The Bickford Drill and Tool Company shipped several carloads of heavy drills and other machine tools on export orders in August, and are filling some large orders in their home trade. They have lately put in a 62-inch G. A. Gray Company planer and two Jones & Lamson turret lathes.

The Silk, Anderson Company has fitted up another room with several new machine tools to increase its facilities and is working a large number of men. It is arranging to put in electric lights and has an additional force for working nights, which is justified by the increase of its business. Its new lathe is stated to be attracting much attention and it is having a very good demand for it.

F. M. Watkins is very busy filling orders for gas and gasoline engines in sizes up to 15 and 25 horse-power. The demand is much heavier than last year. He is preparing to enlarge his plant.

The Lunkenheimer Company has shared in the year's prosperity and has been favored with a continued growth of demand for its specialties by manufacturers of iron and steel products. Export, as well as domestic trade, has increased in volume. The company is considering the necessity of enlarging its facilities before long to take care of the still heavier business which is anticipated with the coming months and the coming year.

The Greaves & Klussman Company is moving into its new building on Alfred and Cook streets, where it will install a number of new machine tools as fast as it can secure them.

The Stirling (water tube boiler) Company has an order for a large number of boilers for the Central Union Railroad Depot here, and has many orders for batteries of boilers going to other points.

The Oil City Boiler Works have many large contracts on hand, besides many small orders, keeping them very busy indeed, and they find an increasing demand for what they make.

The Perfect Lubricating Metal Company is a comparatively new enterprise here. It is finding a growing demand for its babbitt metal.

The Bradford Belting Company reports an increase for this year to date from 25 to 50 per cent. over the corresponding months of last year. Its home trade has been of large volume and it notes among export orders several from Cuba.

The Straub Machinery Company is making an output 50 per cent. greater than last year, and still a larger one over previous years. The demand for gearing is good. Stimulating influences of oncoming autumn have already been felt in one or more lines.

As has been previously mentioned in our columns, Fosdick & Holloway, who have been contractors, building radial drills for the American Tool Works Company, Cincinnati, have gone into business for themselves, and, of course, with a fully organized manufacturing department. They have designed and brought out a new style of machine, possessing a number of improvements, and not the least among the advantages this concern possesses at this time is the fact that they expect to be able to make prompt deliveries.

Quotations.

NEW YORK, MONDAY,
September 11.

Iron — American Pig, tidewater delivery:—

Pennsylvania irons:

No. 1 X foundry	$22 50 @ $24 00
No. 2 X foundry	22 00 @ 23 00
No. 2 plain	21 25 @ 22 00

Alabama irons for delivery in 1900:

No. 1 foundry	22 00 @ 22 50
No. 2 foundry	21 25 @ 22 00
No. 3 foundry	20 00 @ 20 50
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 22 00
Foundry forge	19 25 @ 19 75

Bar Iron—Base sizes—Refined, mill price on dock, 2.20 @ 2.30c.; store price, 2.50c., upward; common, from store, 2.40 @ 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c., and upward.

Machinery Steel—Base sizes—Ordinary brands, from store, in small lots, 2.85 @ 3.00c.

Cold Rolled Steel Shafting—Base sizes—From store, in small lots, fixed at 3.90c., but selling irregularly at 3.75 @ 4c.

Copper—Lake Superior ingot, 18½c.; electrolytic, 17⅝ @ 17¾c.; casting copper, 17½c.

Pig Lead—Carload lots, 4.65c., spot, New York; futures and 50 or 100-ton lots, 4.60c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 32½ @ 32¾c.

Spelter—Prime Western in carload lots, 5.60 @ 5.65c., covering early shipments and spot.

Antimony—In cask lots and over, Cookson's, 11c.; Hallett's, 9¾c.

Lard Oil—Prime, present make, ice-pressed, 44 @ 45c., in wholesale lots for the leading city brand, with lower figures possible on some.

A Large Multiple Tool Holder.

The accompanying half-tone and line engravings illustrate a multiple tool holder of unusual size and completeness. The photograph and blueprint from which the engravings have been made were sent to us by Mr. H. M. Norris, of the Bickford Drill & Tool Company, of Cincinnati, in whose shops the tool is used for turning the columns of their radial drills.

The general appearance is best shown in the half-tone, Fig. 1, but the use of the various tools and the adjustments provided are more clearly shown in Fig. 2. The appliance is mounted on the carriage of a 42-inch lathe from which the regular tool block is removed. The column to be turned is shown in Fig. 2 in proper relation to the various tools. The four cylindrical portions of the column are first roughed out with the lathe running backward, tools 7, 8, 9 and 10 all working simultaneously. The depth of cut is regulated by stops *A* and *B;* the first governing tool 10, and the latter tools 7, 8 and 9; all of which are mounted on the same cross slide. The V or dovetail portion, is then roughed with tool 4, which is mounted in a turret, an enlarged view of which is shown in Fig. 3, after which the V is shaped up with tool 1 and finished with tool 2, when tool 3 is brought into use to turn and face the parts previously roughed with tool 9.

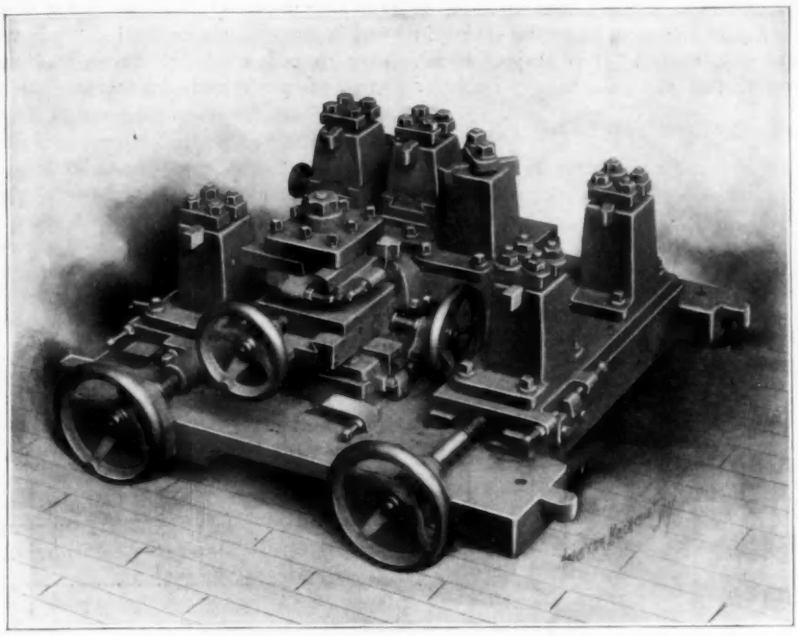


FIG. 1. PHOTOGRAPHIC VIEW OF MULTIPLE TOOL HOLDER.

The complete sequence of finishing operations after the V groove is finished, is as follows:

Operation.	Surfaces.	Tools.
1	*a* and *b*	5 and 3
2	*c* and *d*	5 and 3
3	*e* and *f*	3 and 6

The depth of cut for each of the four turret tools is regulated by independent stops on the turret, clearly shown in Figs. 1 and 3, and by a common stop *C* on the slide, to which the turret is secured. Suppose, for instance, that it is desired to use tool 1. The turret slide is first run toward the operator; the turret is revolved and then run back against its stop, when the main slide is run forward until stop *C* comes in contact with a small slide in lug *D*, not shown. Having finished the work to this point, the three remaining straight surfaces are finished with tools 5, 3 and 6 working simultaneously, for which operation the slide in lug *D* is withdrawn. This slide is used to keep tool 5 away from the work while the turret tools are in use, and upon being withdrawn it enables both operations to be performed with the common stop *C*. The hand wheel for operating the turret crosswise of the lathe is omitted from the plan view of Fig. 2.

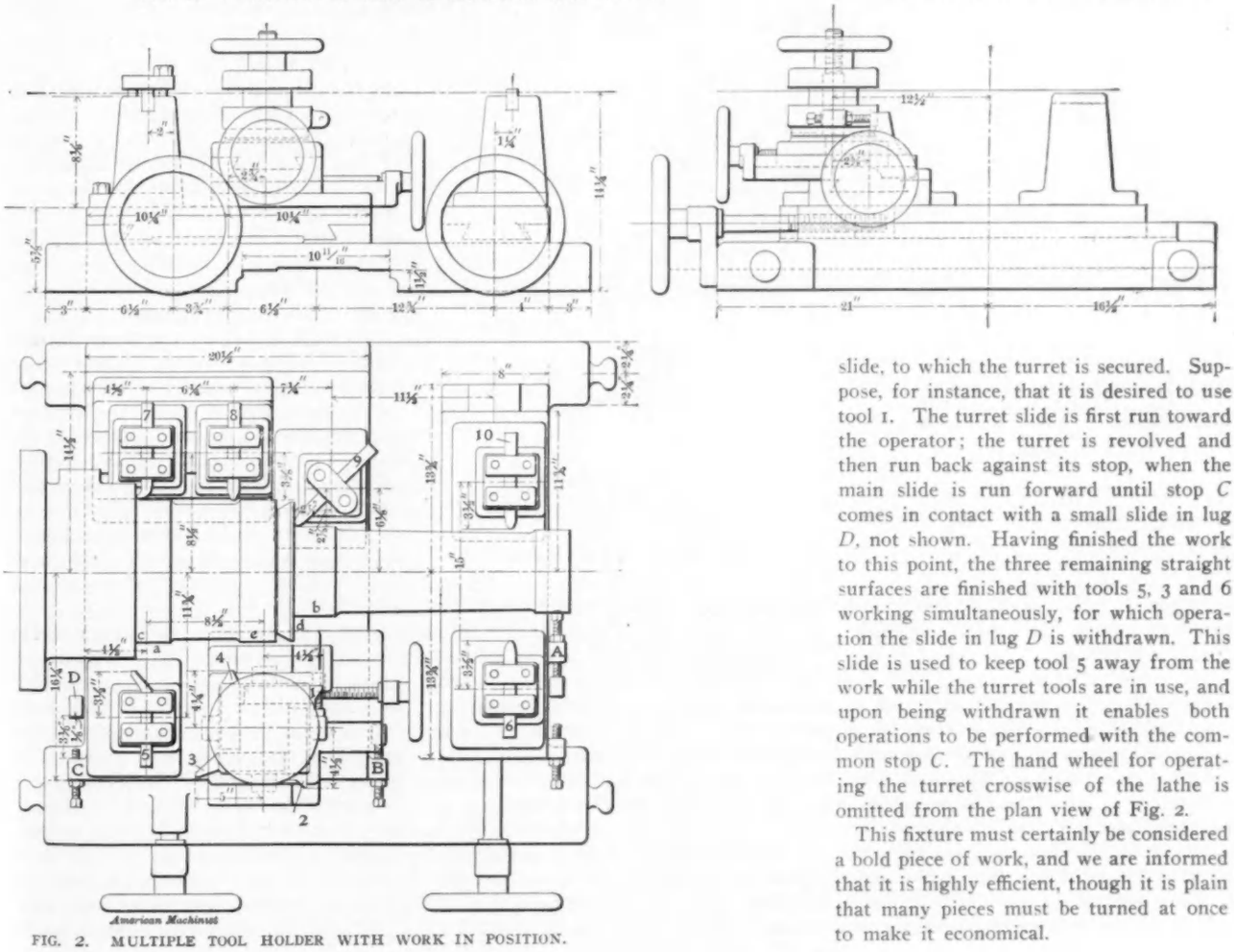


FIG. 2. MULTIPLE TOOL HOLDER WITH WORK IN POSITION.

This fixture must certainly be considered a bold piece of work, and we are informed that it is highly efficient, though it is plain that many pieces must be turned at once to make it economical.

Mr. Darlington on Piece Work and the Premium Plan.

BY F. A. HALSEY.

The readers of the "American Machinist" will recall an article in the issue of June 22, which was offered as a reply to an unfavorable criticism of the premium plan, which appeared in the "Engineering Magazine" for June, from the pen of Mr. P. J. Darlington. This reply has called out a second article from Mr. Darlington, which appears in the "Engineering Magazine" for September.

The second article advances no new arguments, and it certainly does not answer the reply of the June 22 issue. It is, in fact, scarcely worthy of further reply; but as silence is apt to be misconstrued, and especially as the article abounds in misstatements, half truths and quotations which, by separation from the context, are given a wrong interpretation, a few words will be given to it.

How far the author understands the real spirit of the premium plan is shown by his statement that it "pretends to pay in part for the work done, but offers a reward for doing it slowly" (!), and again by his statement that "the premium plan is the result of a disregard of equipment cost," and this in spite of the statement in the original article of the March 9 issue, in which, after enlarging upon the saving in wages cost, I said: "It is obvious to all, however, that the gain to the employer does not stop here—the gain due to the increased output from a given sized plant being additional to the immediate cash gain. In the case of large expensive tools the gain due to increased output may easily far exceed the gain due to the reduction of wages paid per piece."

How correctly he quotes my own words is shown by the fact that he assumes the case of a punch press, of which the output is obviously easily predicted, and says: "Mr. Halsey tells us regarding such rate-setting, that he has 'met very few mechanics who believe it can be done.'" It is hard to be patient with such misrepresentation as this. In his first article Mr. Darlington stated that "the fundamental requirement of both [piece work and piece rate systems] is the knowledge beforehand of what length of time a given operation should take"—a general statement, applying to miscellaneous classes of work, and in reply to which I said: "It is very easy to talk glibly of fixing maximum rates of production beforehand, but we have met very few mechanics who believe it can be done." Mr. Darlington quotes the remark as though it had been made in reference to a small special class of work, and thus distorts it from the appearance of common sense. Everybody knows that after sufficient experience the output of strictly automatic machines may be predicted with a fair degree of accuracy, but most people believe that the time necessary to do the general run of machine shop work cannot be so predicted.

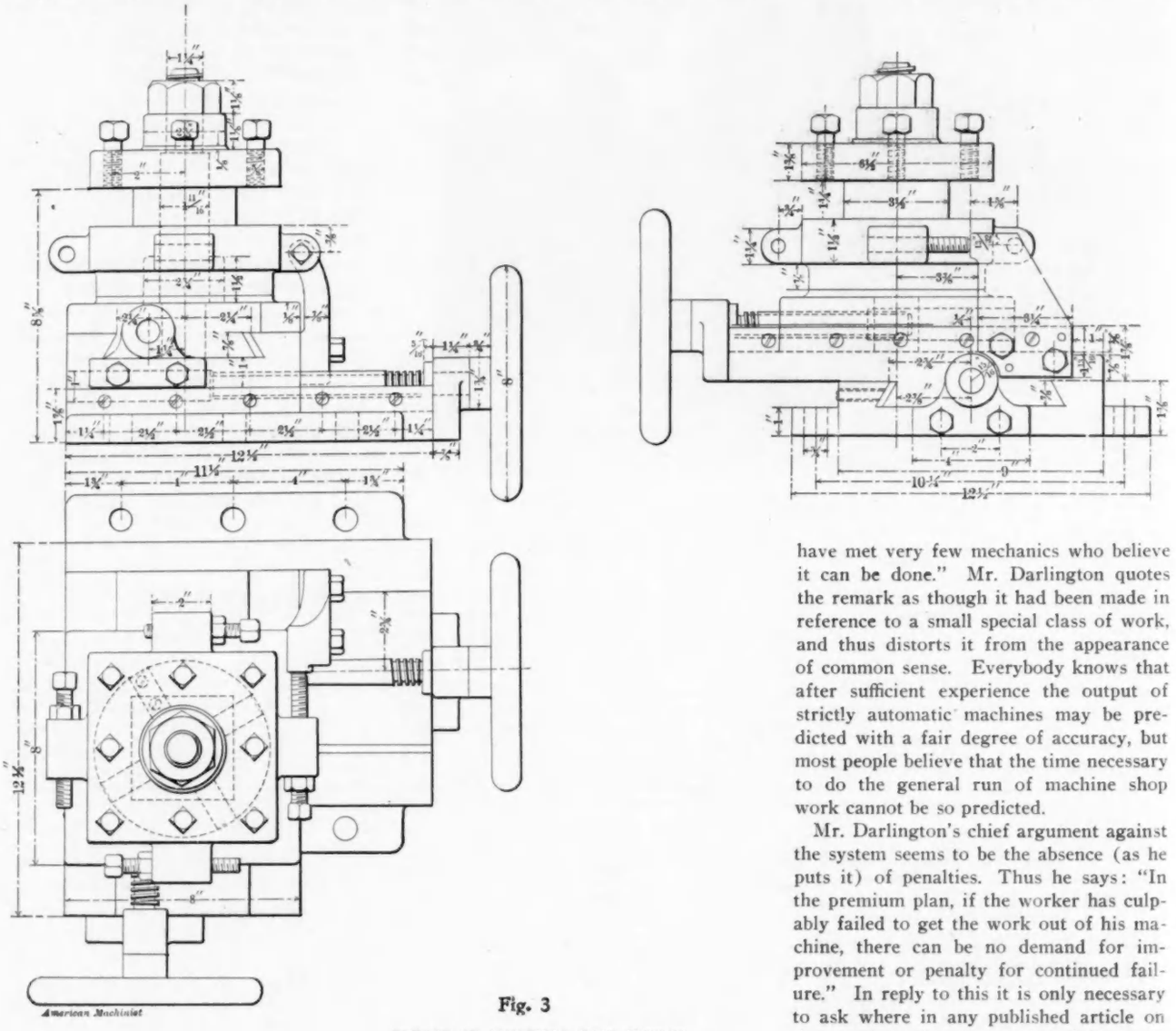


Fig. 3

TURRET OF MULTIPLE TOOL HOLDER.

Mr. Darlington's chief argument against the system seems to be the absence (as he puts it) of penalties. Thus he says: "In the premium plan, if the worker has culpably failed to get the work out of his machine, there can be no demand for improvement or penalty for continued failure." In reply to this it is only necessary to ask where in any published article on the premium plan the penalty of discharge for not doing a fair day's work has been annulled?

Again, where has anything been said to justify the statement, "He proposes to abandon exact and scientific rate-setting, and returns to the primitive methods of rate-guessing"? I have insisted that any system of rate-setting must be based on previous results. Mr. Darlington seems to think that when a method of rate-setting becomes "scientific," it becomes independent of the data on which it is based. He might as well claim that a completed building is independent of its foundation.

Finally, Mr. Darlington's consistency is

shown by the following extracts: "In the premium plan the employer demands all the equipment saving, increased profits and most of the wages saved in addition. Yet the premium plan is presented by its inventor as a profit-sharing scheme." If this has any meaning it is that the employer gets more than his proper share from the working of the system, but later on we find this: "It is impossible to live up to the promises of the premium plan and maintain economy of manufacture," the only possible meaning of which is that, owing to large premium earnings, the employer does not get his proper share. The reader may reconcile the statements if he can.

I can only hope that Mr. Darlington's articles will be widely read, as they will not fail to impress the discriminating reader with the weakness of the argument against the premium system. As a whole, they are composed of rambling irrelevant objections. I have no desire to introduce personalities into the argument, but the author writes like a martinet with his head in the clouds; like one who, in laborious argument over trifles, overlooks fundamentals. He writes at length about the complication of the accounting when there is no such complication. By a twist of words he says the reduced cost due to the premium earnings is "rate-cutting." He forgets that rewards may make penalties unnecessary, and valiantly sets up whole regiments of men of straw whose overturn signifies nothing.

Sweeping a Gear in Loam—Teeth to be Cut Over After Casting.

BY R. H. PALMER.

We are given a piece of yellow paper, and scratched on it a gear drawing like Fig. 1, also an order something like the following: "To be a sound, clear casting, free from blowholes or shrinkholes. Iron to be close-grained, tough, hard enough to wear well, yet easily machined. Wanted in a hurry. Get at it right away."

In addition to the above we get a corebox, in which cores are to be made to form the outside of the rim with the teeth. Fig. 4 will give an idea of what the end of the core is to be. The face of the core at the back is 1 inch higher than the face of the casting. There is a corebox for one-half of the arm, with rib on it as wanted in cope and drag. "There's the whole thing; the old man is in a great hurry; machine shop's waiting," is also our verbal order.

The foreman sends the coreboxes to the flask maker, and has made for Fig. 4 a carcass or grid like Fig. 5; also an arbor pattern like Fig. 2 for the arm cores, only the prickers, Fig. 3, on the under side are left off. To make these prickers he has a piece of wood made the shape and size he wishes them at the point, but longer, and measures the length he wants, cutting a notch. You see, there are two different lengths. Taking the patterns to a molder, he has as many cast off of Fig. 5 as there are section cores wanted to form the outside of the gear, and in the top of each carcass he has a staple of wrought iron cast in, to hook into when setting these cores in the mold. The arm cores have a carcass in each half, see *I*, Fig. 7.

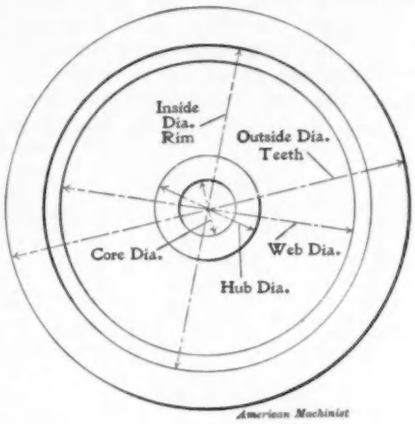


Fig. 1

THE SKETCH FOR THE MOLDER.

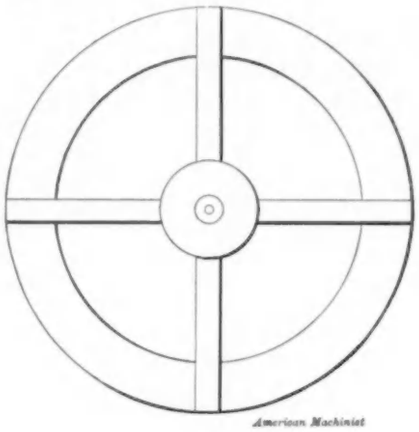


Fig. 6

THE SPINDLE STEP.

Fig. 2

Fig. 3

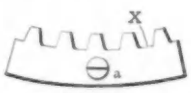


Fig. 4

Fig. 5

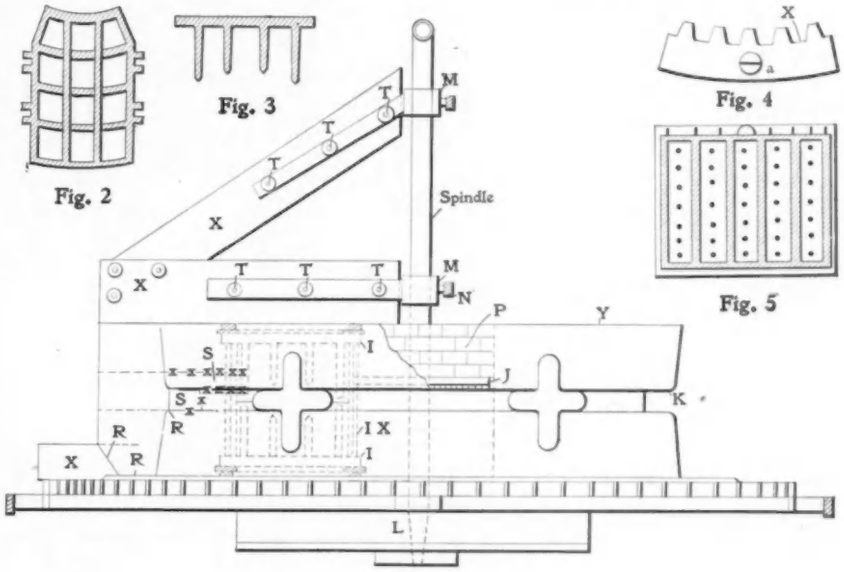


Fig. 7

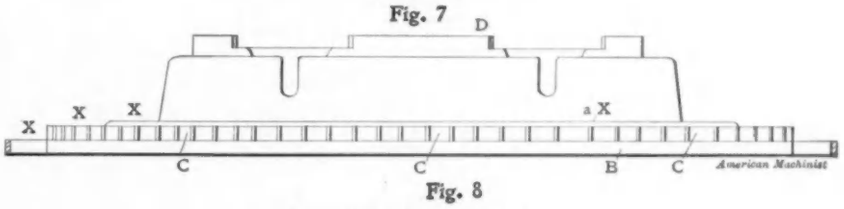


Fig. 8

SWEEPING A GEAR IN LOAM.

In making these the pattern is bedded in the floor, care being taken to allow for the prickers. When the pattern is drawn, the prickers, Fig. 3, are punched with the stick. I have referred to the two different lengths wanted. The castings, being cleaned, are sent to the core-maker, who uses the carcasses in their respective boxes.

In making the outside section core, Fig. 4, the bars in the carcass, Fig. 5, run up and down, and come in front of what will be the teeth of the gear when cast (see *X*, Fig. 4). In Fig. 5 a lot of dots are shown between the bars. In Fig. 10 one of the same bars is shown at *E*. Running between these bars are spikes in the same figure marked *F*. Those dots in Fig. 5 are intended to show the position in the core of these spikes.

In making the core, the sand is rammed in the box as high as wished; the carcass is clay-washed and bedded in. The spikes referred to, having been rammed up in the sand teeth in the corebox (these teeth are to form the teeth of the face of the gear), come between the bars of the carcass, and when the corebox is rammed full vents are run down into the teeth in the corebox, thus bringing vent from the sand

teeth to the back of the core. The arm cores are made, and the vent is brought to the side of the core.

While the cores are making, loam plates are looked over, but none is found large enough so a bottom plate is cast.

The extreme outside diameter of gear wanted is	94″
Depth of core, outside diameter of gear, 7″ × 2	14″
Bricks, 4″ × 2	8″
Shrinkage of gear, call it	1″
Total diameter required	117″

So the bottom plate is cast 9 feet 9 inches diameter.

Now we look at Fig 9, and follow the outside line around. It has four square lugs on its quarters which are used to handle it by, and also to secure the mold when put together. In the center of this plate is left a hole for the spindle to stick up through, and triangular places are cast between arms *S S S*. The covering plate for the rim is cast the same size as the bottom plate, with four lugs to match; but this plate does not extend to the center, only coming to line *O*, Fig. 11. This plate has two holes in it for risers, and it is better to cast extra holes, so that it may come in play for other jobs. It also has prickers to hold the loam on its face, say pointed 5/8 inch long. A third plate is cast for covering the hub. This plate, *X X*, Fig. 9, has four lugs for bolting it down. These lugs have each a slot to receive the bolt, also prickers to hold the loam on the face, and in the center a row of holes through which the casting is poured. In making the holes they are 1 to 1¼ inches larger in diameter than the gates used, to have loam around the gate to resist the action of the iron when entering the mold (see *G*, Fig. 11).

We now have the three larger plates. At *J*, Fig. 7, between the arm cores, is a plate with prickers on it; this is to carry the overhang to form a web around inside the rim of the gear, *K*, Fig. 7.

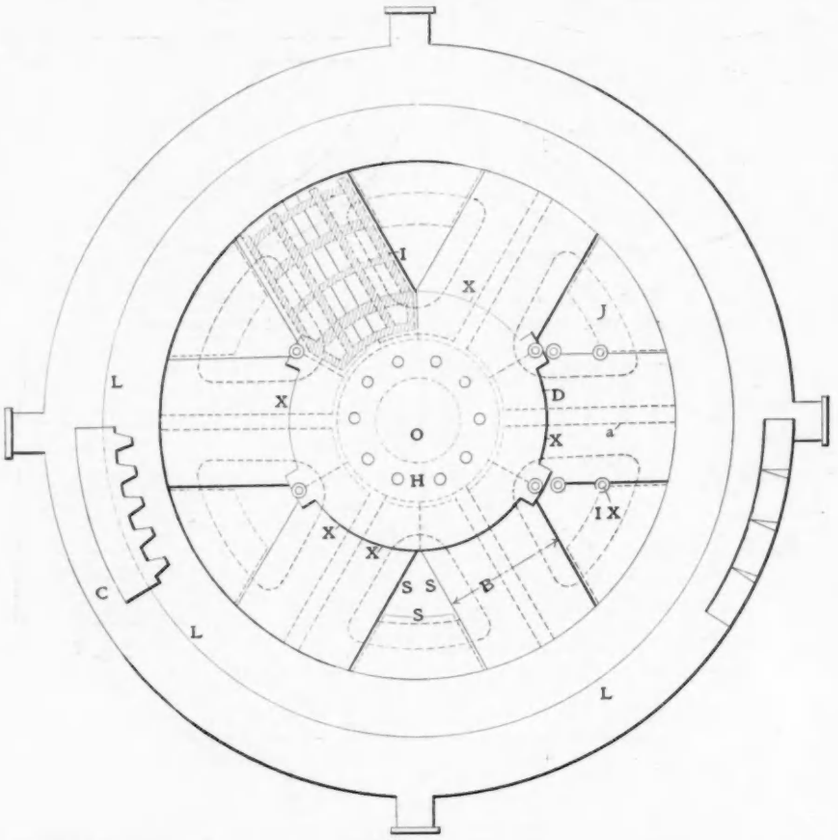


Fig. 9

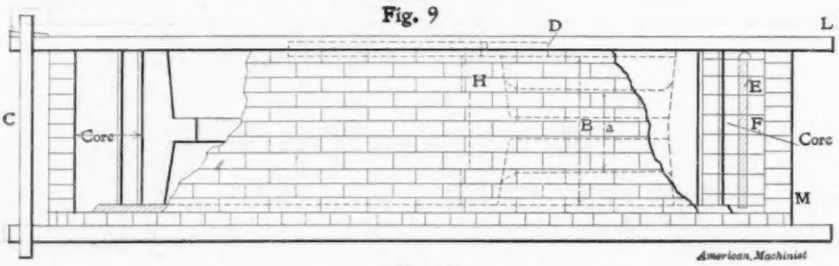


Fig. 10

PLAN AND PARTIAL VERTICAL SECTION OF MOLD.

At *J*, Fig. 9, the width of this plate is seen. It is cast thin, comparatively, with prickers on it. Please notice that these plates do not come close against the arm cores. What would be the result, when this gear shrunk in cooling, if the center were made so that there should be no chance for the walls to give? Six of these plates are cast, and put to one side.

The stirrups are on hand or made; the spindle and seat are in stock. The loam has been mixed, consisting of 4 parts fire sand, 1 coarse Jersey molding sand, 1 ground clay, 1 sawdust (white pine) or horse dung. Mix with water or sour beer. Let the mixture stand at least over night. Some persons have a loam bench and a sort of knife, and keep slicing it for a while. Others mix in a trough as one would mix mortar. The point is to get it evenly and thoroughly mixed. Different parts of the country also use different mixtures, yet obtain the same results. We also take a mud box and in it mix a sort of mortar to lay the bricks in, the loam being for facing the mold. The mud is mixed so as to form an open, porous mass through which gases from the loam can escape; thus any old, coarse, burnt sand, with clay water, is good enough.

We now take the spindle seat, Fig. 6, and bed it into the floor, ramming the sand firmly around it, having the spindle in the seat, and being sure that it stands perfectly upright.

Referring to *L*, Fig. 7, the spindle has a long bearing and a great deal of taper. This is so that the spindle, which is turned the greater part of the time in the same direction, will always be wearing itself into the bearing; and with this kind of a seat the best results are obtained, for a seat that is moved from place to place and taken and stored away when not in use.

We then take finger *M*, Fig. 7, placing it on the spindle, and tighten set-screw *N* and bolt on a strike, and strike or sweep off a level bed around the spindle. Taking out the spindle, we lower the bottom or foundation plate *B*, Fig. 8, on to this bed, bringing the center of the plate to the center of the spindle. Care in making and setting this plate will usually cause everything to come right.

Replace the spindle and, raising the sweep, run it around and prove it. Next, to the fingers on the spindle is bolted a sweep which will sweep lines *X X X*, Fig. 8; also the bearings or seats for the arm cores to rest on, also the bottom of the hub and core-print, if you choose, or have a core-print split and cut out for the spindle. Following the lines marked *X X X* referred to, it will be seen that it is about the same as Fig. 8, with all above *a X* cut off. Having set the sweep so as to leave a thickness of brick with room enough to lay them on the plate in mud, as a mason lays bricks in mortar, and room for, say, 5/8 to ¾ inch of loam on top of the bricks,

we proceed to lay the bricks on the plate as I have tried to show at *C*, Fig. 8, keeping the brickwork below the sweep, as I have stated, for the loam. We then put on the loam, finishing the bottom of the hub first, and then removing that part of the sweep which is screwed on to the sweep proper. The rest of the brickwork is loamed and given the finishing coat. We have then the lines referred to. The loam has now to be left to stiffen, or "set up," as the molders say. While this is taking place the molder takes the plates I have referred to, and loams and blacks them, and places them in the oven to dry.

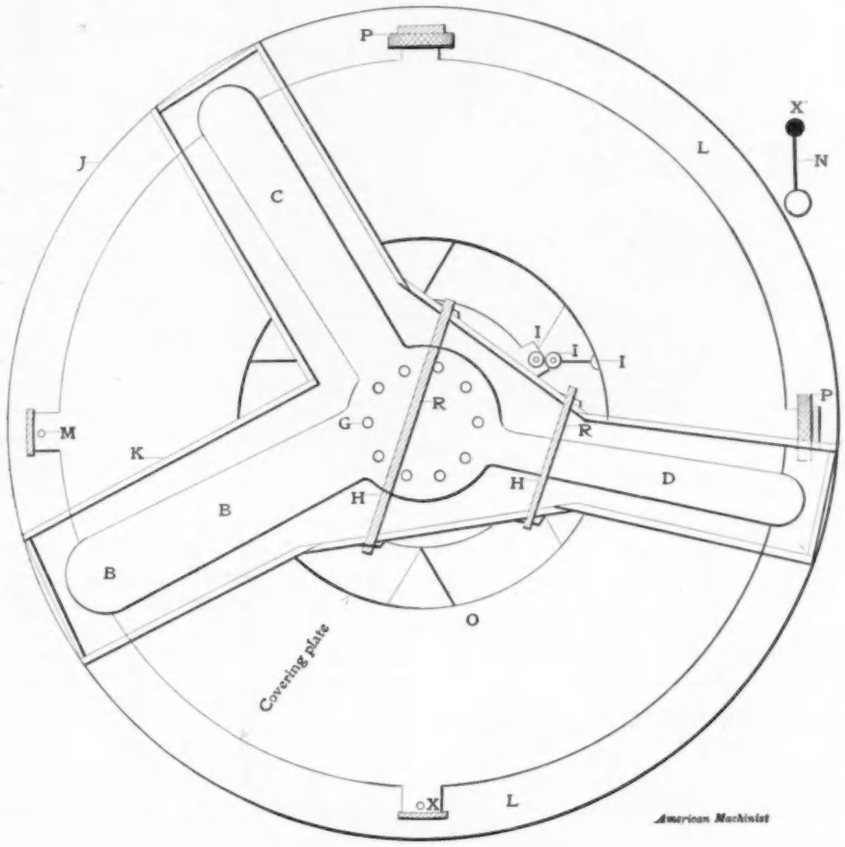


Fig. 11

TOP OF THE MOLD.

The loam now being set enough, the lower half of the arm cores are placed in position and bedded in the loam on their seat. Of course, the distances between centers of the cores are spaced, and the cores are leveled. The outside ends of the arm cores are set so that the strike *X X X*, Fig. 7, will just clear them.

The brick work is then built in between the arm cores to the hight of *D*, Fig 8, and loamed and given a finishing coat. The piece of sweep *S*, Fig. 7, bound by lines marked *x x x*, is removed from the strike, it being intended to strike only the depth of the web, and the nuts at *D* for the plates to go between arms. These plates are now looked after. The top half of the arm cores are next placed in position, being carefully pasted between, and the hub being formed by the arm cores meeting near the center. Great care is taken that the cores not only match well, but that the spaces between the cores are well pasted, as everything depends on its being done in a proper manner. One leak of the iron here in pouring might cause the loss of the casting.

The cores are also bolted together as shown at *I X*, Fig. 7, *I X*, Fig. 9. It is now seen what the lugs are for in the sides of the arbor, Fig 2—to slip the rods in to bolt together, and also to handle in setting the cores.

The next move is the bedding on top of Fig. 7, *K*. The plates are shown at *J*, Fig. 7, J, Fig. 9. The brickwork is then built in on top of them, Fig. 7, *P*. The bricks are laid in the mud mortar, as I described in the start.

This part of the mold being loamed, we let it set, up to a certain point. It must be just about so hard, as, if blacked too soft, the blacking will soak in too much, and will not peel off readily in cleaning. On the other hand, it must not be too hard. Some molds we dry and then black, but this one is supposed to be blacked green. In every part of the country they have a different way of mixing loam, and it is so with the blacking. One will condemn what will please another. I have found silver lead mixed with a thin clay wash, and added to it a portion of boiled starch, gave very satisfactory results.

We now take bolts *T T T*, Fig 7, out, and remove sweep, also take off fingers *M M*. Then we take arm *B*, Fig. 12, and, placing it against spindle, with a cap on other side, we bolt the two together, *D*. A light chain is run through the eye in the top of the spindle, as shown by line *C*, Fig. 12, and secured around two short pieces of iron, shown at *E*, as holes in the arm. Two fire baskets containing lighted charcoal are next hung on the ends of the arm, as shown by *2X*, *2X*, Fig. 12. These baskets are made by making a pattern the size wanted at *F*, Fig. 12, and after molding it in open sand, sticking into the sand a row of rods all the way around, casting it in open sand, as it is termed, running the molten iron around the rods. A second one has been molded, and, as the second one is to form the bottom *G*, cross rods are bedded into the sand with ends sticking out into mold to form the bottom, and when the first one has been cast it is brought over to second and stood up in second mold and iron poured into *G*, thus forming fire baskets shown at *2X*, *2X*. A boy or a man is then set to slowly revolving these fire baskets around the mold. It must not be too fast. Neither must it be too slow. One will burn and the other will not dry evnly; so there must be a sort of time motion. Assuming the mold to be dry, we remove spindle and arms and baskets, and hang a fire basket in hub and dry that.

It may be inquired what the line *a X* was for, in Fig. 8. At Fig. 10 it will be seen that the bottom of the core is fitted to meet this offset in the seat. This sweeping must be done carefully. The same line is seen in Fig. 9 *L*, and how important that they about match.

We now take the section cores forming the outside of the gear, and hooking into the staple cast into carcass, *A*, Fig. 4, we set them around the outside, as *C*, Fig. 9. The spindle has been replaced, and one of the fingers on it. To this finger is bolted a gage, and to this gage, or distance from the center, every core is set.

If the cores have not swelled, and they have been laid out right, good! If not, trouble! In this case everything came right.

At the back of the cores a brick wall was built, *M*, Fig. 10, the bricks being laid in mud only where the ends came together, then the fire basket was used and the brick work dried. The covering plate, Fig. 11, having been loamed and dried, is tried on, and when fitted, secured by stirrups *P*.

The spindle being taken out for good, we fill up the hole with sand, and set the center core in its print, centering it. Now, looking at Fig. 9, the line *X X* is seen, and following the line around you have the center covering plate, in the center of

which is a circular line of holes for pouring gates. When this plate was loamed the galesticks were placed in the holes and loamed around, the holes in the plate being 1 inch to 1¼ inches larger in diameter than gates, thus giving a thickness of loam between the inflow of iron and plate. You will also see the lugs that are used to bolt down this center plate, pieces of iron being slipped under the lower plate in this point of the open triangle cast in the plate, the bolt going through this piece having

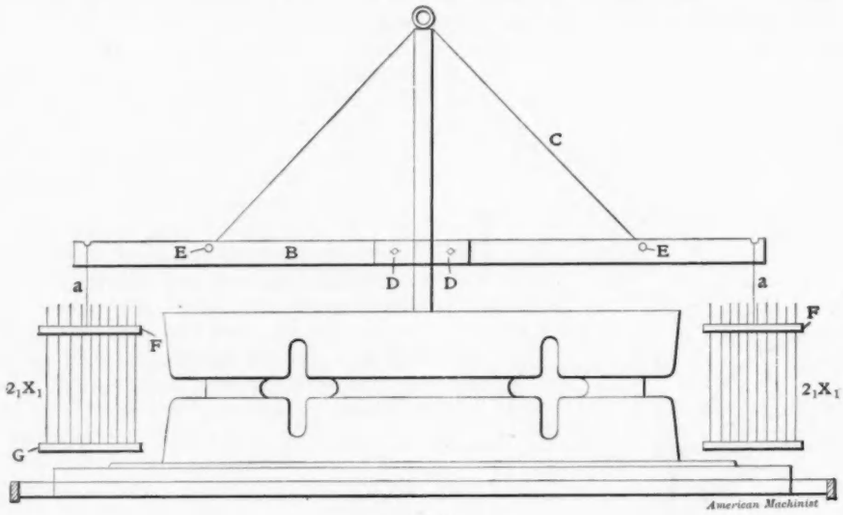


Fig. 12

DRYING THE MOLD.

either a head or a nut beneath. I like a rod with a nut on each end best for foundry use.

The curb, consisting of plates of boiler iron, is next set up around the mold and bolted together, forming an outside ring to stand the outward pressure of the iron, and sand is firmly rammed between brick and curb; also sand is rammed between the arms in triangles part way up. A few vents are arranged back of brickwork to take gases from teeth cores.

As there was not a ladle holding iron enough to pour the gear, two cranes had to be used, one being so poor that it could only be relied on to steady a ladle on horses. Crane ladle on runner *B*, other ladle on *C*, and while the large ladles were being poured a few hand ladles were carried around and poured into *D*, thus getting enough iron to fill the mold, Fig. 11.

This style of runner called for a special runner box. Clamps *R R*, Fig. 11, were used to keep the runner box from spreading. At *N*, Fig. 11, *X* is a solid ball of iron with a rod, say, 9 inches long cast in it, having an eye in the end. These balls and rods are dipped in blacking and dried. One is then set over each gate after the runner has been made and gate-sticks drawn out. When the first ladle is started, as soon as there is a sufficient depth of iron in the runner, a man with a hook commences to catch into the eyes and remove the balls, thus governing the inflow of iron to the mold, and in this way letting the clean iron flow from the bottom of the runner, and preventing the scruff collected by the first wash of iron along the runner from entering the mold.

Remember in laying bricks for a center of this kind, to so arrange them that when the squeeze comes in the castings shrinking, the brickwork can give.

The gear, after pouring, was allowed to remain in over the next day, and when taken out was easily cleaned; and when faced off and the teeth cut over, proved a good, sound casting.

Someone may ask if those balls of iron will not float with the inrush of iron in the runner. I have used them many times, and never knew of but one floating.

Some Grand Rapids Marine Engines.

BY BAXTER ASLAKSON.

Mr. Charles Sintz was one of the earliest as well as most persistent men in putting the internal combustion motor on its legs in this country. A long time ago, when Otto was in his glory and Diesel in knee-breeches, Mr. Sintz, then living in his native city of Springfield, Ohio, was blowing in his time and money solving the mysteries of the gasoline engine, largely for the benefit of those who "lay low" and said nothing, until they found it was a sure thing. All the gas engine works of Dayton and Springfield can probably be traced to Mr. Sintz's early efforts there. By this is meant no reflection on the manufacturers of Dayton and Springfield, but simply to emphasize the influence of Mr. Sintz's work and to call attention anew to the adage that the path of the inventor is not strewn with roses.

Naturally enough, it seemed necessary to the first constructors of gasoline engines to use some sort of "carburetor" to gasify the oil before admission to the engine, and so all sorts of long-spun schemes for "mixing" and "atomizing" were used. It took considerable time and expense to find out that the low boiling point of gasoline obviated all necessity for these devices, and that it was sufficient simply to suck the oil directly into the air supply pipe. In saying this the writer has in mind only the ordinary small gasoline engine. The best test of good combustion in gasoline engines is the condition of the exhaust gases, for as soon as there is an excess of oil in the mixture, there is apt to be a little smoke.

'Way back in the windmill age, when Mr. Sintz was the only man between the Susquehanna and the Wabash who was working on gasoline engines, he used up a lot of good pig iron finding out these things.

Mr. Sintz, together with his two sons, is now connected with the Wolverine Motor Works, engaged principally in making marine engines under the Sintz patents. The Wolverine motor is an interesting machine, as it is a perfectly practical reversing internal combustion engine. It is of the two-cycle type. The two-cycle engine has never been much respected by thermodynamists, since its first bow was made before the public. Even so accomplished an engineer as its original inventor gave it up as a bad job. By years of experimenting, however, it has at last been brought to a degree of perfection, both in fuel economy and reliability that was not

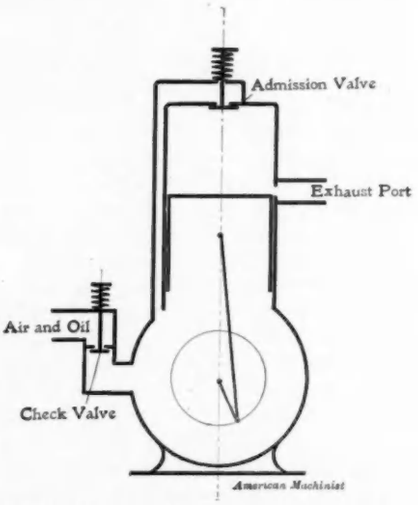


FIG. 1. DIAGRAMMATIC SECTION OF WOLVERINE GASOLINE ENGINE.

thought possible. It is now used for small marine motors almost exclusively. Most engines of this type use no valves for admission and exhaust, but, for accomplishing this, ports are cored into the cylinder which the piston head over-travels. The exhaust port is uncovered first to drop the pressure, which, being about three times greater than the admission, would cause some commotion by rushing into the latter. Mr. Sintz has placed a poppet suction valve in the cylinder head, as shown in the diagrammatic layout in Fig. 1. With

this arrangement the admission valve cannot open before the inside pressure has been reduced to that of the atmosphere. By dispensing with the double port in the cylinder there is also some gain in effective stroke. It is the proper thing to admit the new mixture from the top, since there is less danger of premature explosion at the top where combustion commences.

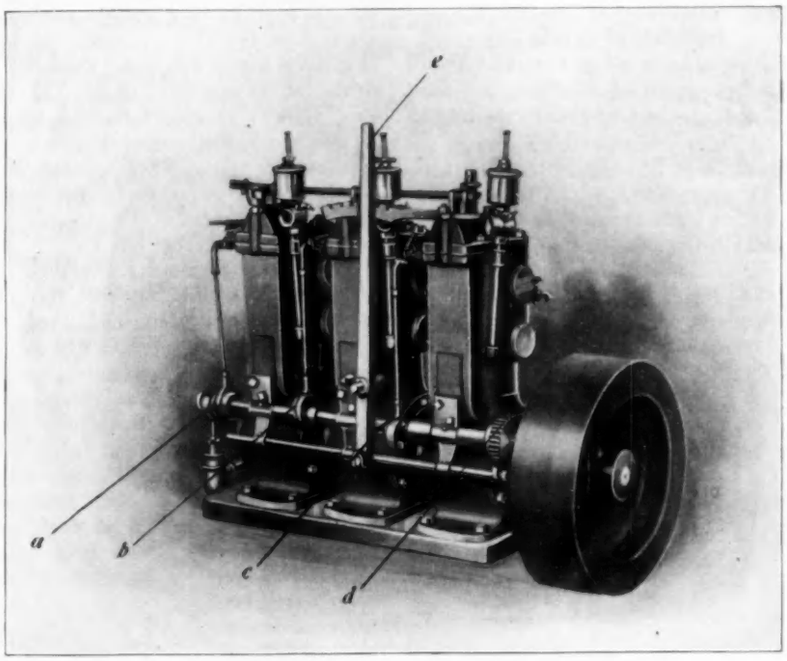


FIG. 2. FRONT VIEW OF WOLVERINE GASO LINE ENGINE.

This matter of premature ignition has always been the sorest trial of the two-cycle experimentalist, and through many a sleepless night has the inventor longed for the gloaming of the dawn to try some new expedient, only to be baffled by the old-time pop into the admission chamber. Great things could be accomplished with the money spent in nursing the fitful fancies of the "two cycle." But, after all, the public may have been well served, since the two-cycle engine has come to be a very reliable servant.

The Wolverine motor is built with single, double or triple cylinders, all self-reversing. The diagram in Fig. 1 shows the general layout and explains itself. It is astonishing to see the speed at which some of these engines run. Mr. Sintz has an 8 B. H.-P. engine that runs regularly at 1,200 revolutions per minute, or 20 complete cycles per second. That means ignition and full flame propagation in about one-eightieth of a second. Of course by letting it spin as fast as its little heart desires there comes a time when throttling prevents further increase. The success of the poppet valve at immense speed and hard service in the gas engine may some time be a revelation to the slow-pokers who build air and ammonia compressors. It may also become valuable to steam engineers when they are driven to take up and conquer the seeming difficulties of a complete super-heating system, since the higher temperatures and pressures may make the poppet valve quite a necessary adjunct to a properly constituted steam engine. Fairbanks, Morse & Co. have for some time been making a combined air compressor and gas engine, in which the driven piston is simply an extension of the driving piston, and therefore plainly runs at the same speed. This engine runs quite as fast as their standard engine of the same size. The engine is supplied with the usual governor. There is also an auxiliary pneumatic governor for by-passing the air discharge when the storage pressure is excessive. A compressor of about 10x16-inch cylinder capacity is run at about 225 revolutions, or 562 feet piston speed, per minute. But to step from this digression: Figs. 2 and 3 are front and rear views of an 18 B. H.-P. Wolverine motor.

Cylinders are 6x6 inches.

Suction valves 3 inches diameter.

Crank shaft 2¼ inches diameter.

Speed 240 revolutions per minute.

Compression in the crank case about 5 pounds per square inch.

Cylinder compression 90 pounds.

In a duplex or three-cylinder engine each crank case must, of course, be distinct and separate from the others, or there would be no compression, since in a duplex engine cranks are 180°, and in a triplex engine 120° apart. There is no box to keep the crank cases tight, the long bushings in the bearings answering this purpose. The three throw cranks are made from a solid forging. In turning them they employ an eccentric steady rest, such as Mr. Randol described as being in use in the Struthers & Wells shops. There is no adjustment in the crank shaft bearings. It is clearly seen that it requires some careful machine work to get out the three crank cases, covers, bearings and bushings so that they will be in perfect alignment.

The Wolverine Motor Works guarantee a B. H.-P. for 10 hours on one gallon of gasoline on an 18 B. H.-P. engine. This seems almost incredible for a two-cycle engine, and I leave it to those who may be interested to fight it out with the Wolverine people.

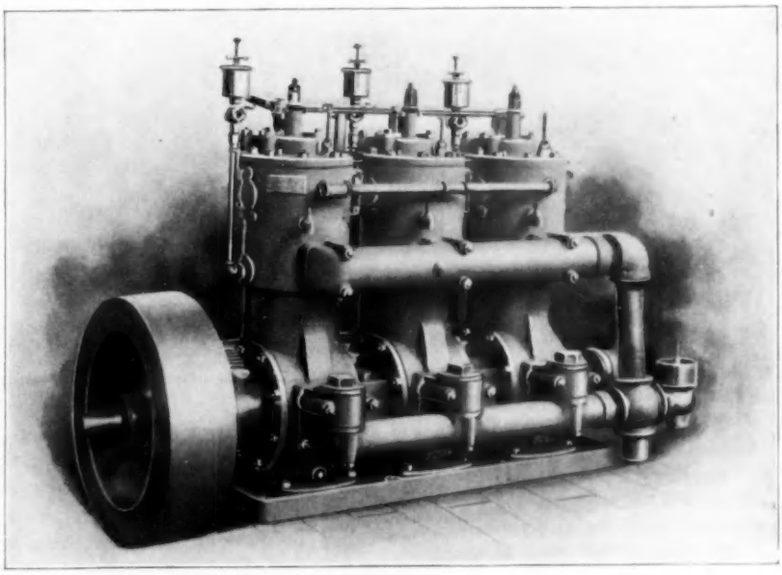


FIG. 3. REAR VIEW OF WOLVERINE GASOLINE ENGINE.

The specific gravity of gasoline with a boiling point of 176° Fahr. is 0.65.

1 gal. of oil therefore weighs 0.65×8.33.

Assuming heat of combustion as 18,000

B. T. U., the heat expended for 10 hours equals

$8.33 \times 0.65 \times 18{,}000 \times 778$ foot pounds.

1 B. H.-P., 10 hours $= 33{,}000 \times 60 \times 10$ foot pounds,

or actual efficiency equals $Ea =$

$$\frac{33{,}000 \times 60 \times 10}{8.33 \times 0.65 \times 18{,}000 \times 778} = 26 \text{ per cent.}$$

With compression to 104.7 pounds absolute, the volume of mixture before and after compression must be as 100 is to 24.85.

And cyclical efficiency equals

$$Ec = 1 - \left(\frac{24.85}{100}\right)^{.41} = 43\tfrac{1}{2} \text{ per cent.}$$

The combustion efficiency is the most important of the gas engine efficiencies. Let it be determined from these data:

Ek = Combustion efficiency is the ratio of the area of an actual indicator diagram to the area of the corresponding ideal diagram.

Ec = Cyclical efficiency at 104.7 pounds compression = 43.5 per cent.

Em = Mechanical efficiency = assumed 85 per cent.

Ea = Actual efficiency = claimed 26 per cent.

$$Ea = Ec \times Ek \times Em$$

therefore $Ek = Ea \div Ec \times Em$

$$= \frac{26}{100} \div \frac{43.5}{100} \times \frac{85}{100} = 70.3 \text{ per cent.}$$

If 19,000 B. T. U. be taken as heat of gasoline $Ek = 67$ per cent.

Such efficiencies for this class of engine are something out of the ordinary. The writer will leave the sponsorship for this with the Wolverine Motor Works.

The reversing is effected by means of the igniting device, driven from eccentrics whose position relatively to the main crank pin can be shifted back and forth, just like the reversing of a steam engine, by shifting the eccentric around the shaft.

Fig. 4 shows the principle of reversing diagrammatically:

$X\ Y$ = center line of cylinder.

C_1 = crank pin when running forward.

C_2 = crank pin when running backward.

E_1 = center of eccentric for driving igniter when running forward.

E_2 = center of eccentric running backward.

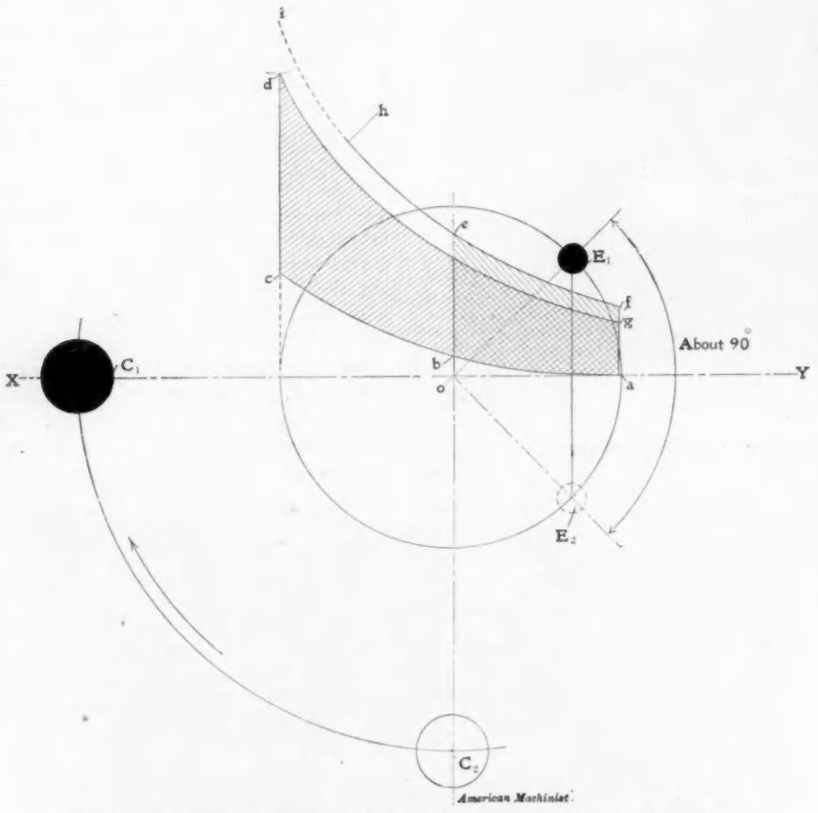


FIG. 4. ACTION OF REVERSING GEAR OF WOLVERINE GASOLINE ENGINE.

When the angle between the crank pin and eccentric equals $C_1\ O\ E_1$, the standard indicator diagram $a\ c\ d\ g$ is constantly repeated. Assuming instantaneous flame propagation, ignition occurs when crank pin is at C_1. But when E_1 is moved 90° ahead to E_2 ignition takes place when crank pin is at C_2, corresponding to b on the indicator diagram. Assuming instantaneous propagation, the pressure rises to c and the piston is compressing along $e\ h$. If the energy of the system carries the engine over the center the pressure will rise to i, but assuming that the engine stops with the indicator point at h, it will start backward, tracing the diagram during this double stroke, $a\ b\ e\ h\ f$. The kinematic relations are now in the proper order for running backward.

Fig. 2 shows the three igniter eccentrics, a b and c, on the same shaft. This shaft, of course, turns at the same angular velocity as the crank shaft, with which it meshes through an intermediate gear, not seen.

Wheel d is connected to the eccentric shaft by a spiral spline, so that if d be kept from rotating while moving along its axis on the eccentric shaft, the latter is given a rotary movement proportionate to the lateral movement of d. The wheel (not shown) is wide enough to allow d all the movement necessary without unmeshing the teeth. These relative movements are accomplished by the lever e. The total movement of the eccentric shaft relatively to d is about 90°.

The engine is also self-starting. The following description of this feature is from the manufacturers themselves:

"About four years ago this firm brought out a reversible gas and gasoline engine, and although the popular expression of manufacturers of that line of motors was that it was impossible to make a successful reversing gasoline engine, the opposite has been proven by the practical demonstration of four years, during which this company has turned out (aside from its non-reversing and stationary engines) over 200 reversible engines.

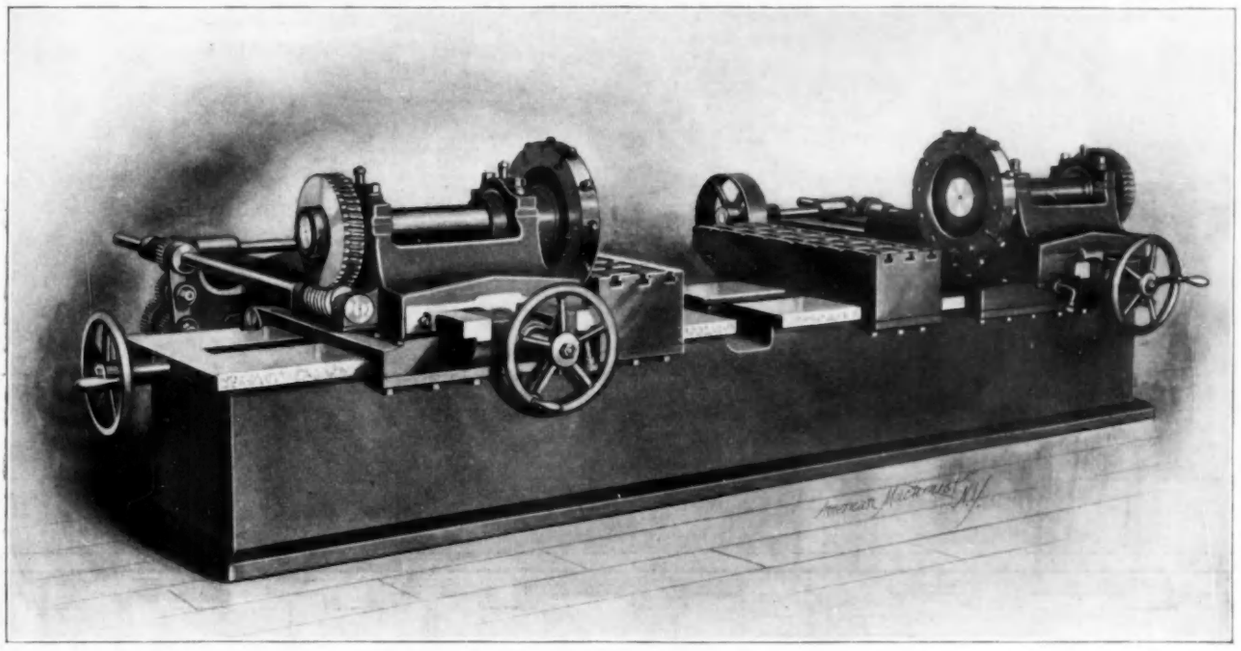
"Since this important feature has been made a success, the only objection that has been raised against the gasoline engine by purchasers is the necessity of turning the engine by hand in order to get it started. This objection has not been raised so much when the smaller powers are needed, as it requires but a small effort to turn them; but in the larger powers, or for 6. H.-P. and larger, this starting by hand necessitates quite an exertion on the part of the operator, and has necessarily been a great objection, especially to parties that expect to operate the engine themselves, and only as a matter of pleasure.

"With the self-starting engine all that is necessary for the operator to do when the engine is to be started is to throw the reverse lever over in the direction that the engine is to run. This is all that is necessary when engine has been in operation before, within an hour or so, and which would insure a charge of gas in the cylinder; if not, pour a small amount of gasoline (about a teaspoonful) into the charging cups that are furnished in the cylinder heads, then throw the reverse lever over, and the engine starts of its own accord.

"To reverse this engine it is only necessary to throw the reverse lever over to the opposite end of its quadrant. To increase speed and power of engine, hook the reverse lever up toward the center of quadrant."

A Traveling Head Duplex Miller.

The half-tone herewith requires little explanation as to the character and capabilities of the machine represented. The function of the machine is a simple one, that of facing the ends of material, such as columns, legs, beams, side-frames and cross-bars of machines, or any end surfaces that come within its scope, and in machine building establishments generally there is usually much work to which this machine is specially adapted. The work to be operated upon is bolted firmly to the two heavy sliding blocks clamped upon the surface of the bed, and all the movement of adjustment and of cutting is done by the revolving cutter-heads and their standards. Each cutter-head is movable endwise of the frame 40 inches from the center, or work up to 80 inches in length may be faced between the cutters. The cutters have a feed crosswise of 26 inches, the feed and movement of each being entirely independent of the other. In many cases the machine is used for facing pieces which require machining only upon one end, and in that case the operator may be setting or changing the work for one cutter while the other is cutting, and one cutter or the other is always at work. The cutter circle is 13 inches, and there are twelve cutters in each head, of ½-inch square mushet steel. The cutter spindle is heavy, with large bearings and rigid support. The worm-wheels are of bronze, and the worms of steel running in oil-pockets. As the cutters are moved across the work, the feed being from the front of the machine backward, the splined worm-shaft slides in a bevel gear at the back of the machine, this gear meshing into a gear on the driving shaft. The driving shaft for each cutter carries a single pulley which is belted from a drum overhead, there being a separate drum for each cutter. The speed ratio of the driving shaft to the cutter spindle is 20 to 1. The feed is according to the character of the work, and may be changed by changing a gear of the feed train. The hight of the center of the cutter spindle over the bed is 11½ inches. The bed may be made of any length required, and for overhanging work the cutter heads may be made larger in diameter. The machine here shown occupies a floor space of 12x6 feet. It is built by the Garvin Machine Company, New York.



TRAVELING HEAD DUPLEX MILLER.

Aluminum in Great Britain.

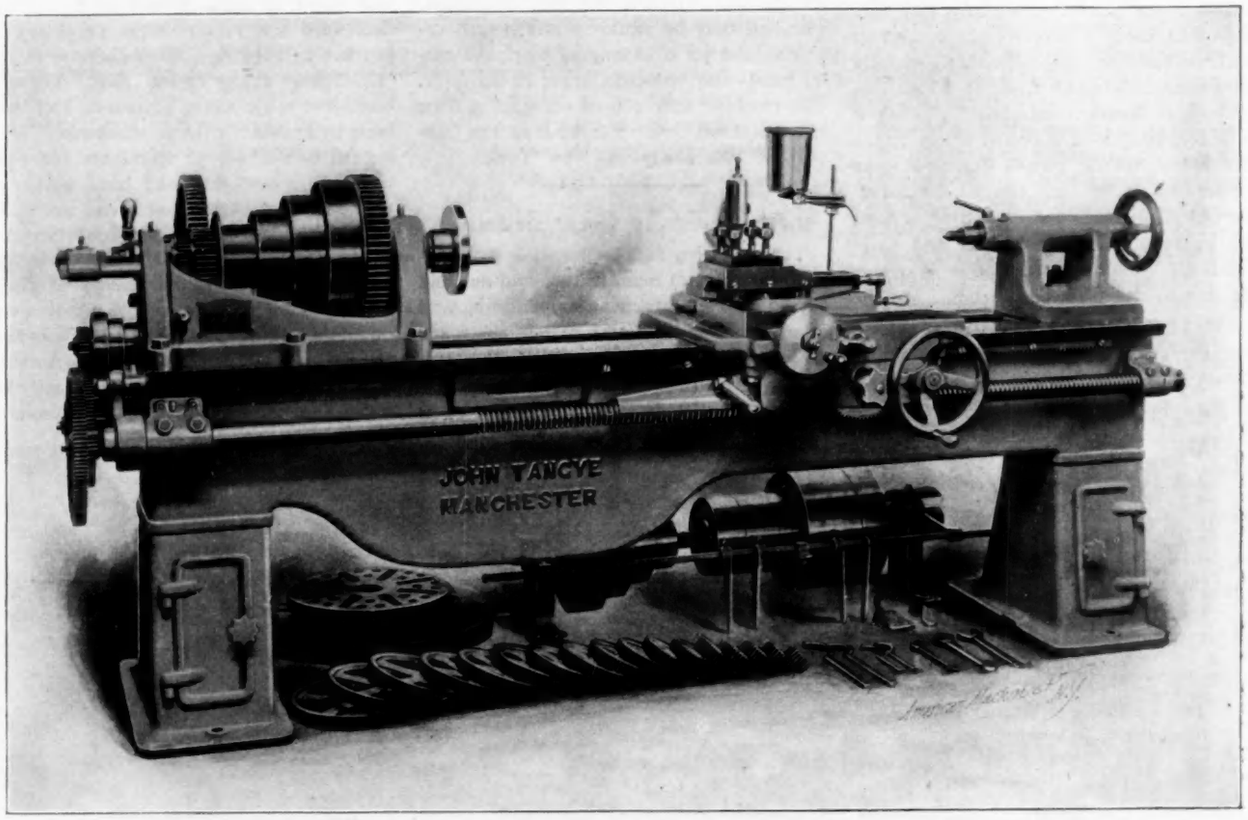
The following facts concerning the present conditions of manufacture and demand for finished aluminum in shipbuilding and other industries in Great Britain are taken from an address of Mr. R. W. Wallace, Q. C., who presided at the recent general meeting of the British Aluminum Company. He said: "All the company's factories were working satisfactorily. As to the demand for aluminum, it was making steady, if only comparatively slow, progress. During the last six months of 1898 their sales increased by 48½ per cent., as compared with the figures in the corresponding period of the preceding year. The German army was more or less equipped with aluminum utensils, and German ships of war had internal fittings made almost entirely of the same metal. In reference to the general trade, he had to tell them on a former occasion that the demand was stopped on account of a strike; but now the ground of complaint was that nearly every workshop in the country was fully occupied with other classes of goods. A good deal had been said with regard to the injurious action of sea water on aluminum, but the board knew by long experience that aluminum did not deteriorate in salt water to the extent that had been alleged. The yacht "Defender," which won the last international race, was built very largely of aluminum, and, after four and a half years, she was found to have deteriorated so little that very few repairs were necessary to put her in condition to compete with the "Columbia" at the recent trials. Torpedo boats and other ships, moreover, had been built in France partly of aluminum. With regard to the use of aluminum for electrical purposes, that had been going on very fast in America, but it had not made so much headway in this country. According to Lord Kelvin's recent investigations, the electrical conductivity of aluminum was 60 per cent. of the conductivity of copper, bulk for bulk. As, however, aluminum was only about one-third of the weight of copper, it was apparent that about one-half the quantity of aluminum gave a corresponding amount of electrical conductivity to that given by copper. Therefore, at the present price of copper aluminum was much cheaper to use for that purpose, besides having the great advantage of lighter weight in connection with telegraph poles. . . . Lord Kelvin said that in the fittings of ships aluminum had proved valuable, convenient and of great practical utility. As to the actual construction of ships with aluminum, that was a matter which would have to be settled by the experience of engineers. He did not believe that the question of the efficiency of protecting aluminum by paint had yet been gone into sufficiently. If they compared an unprotected aluminum plate with steel or iron, he thought that it would be found that the former did not rust away so quickly as the latter."

A New English Lathe.

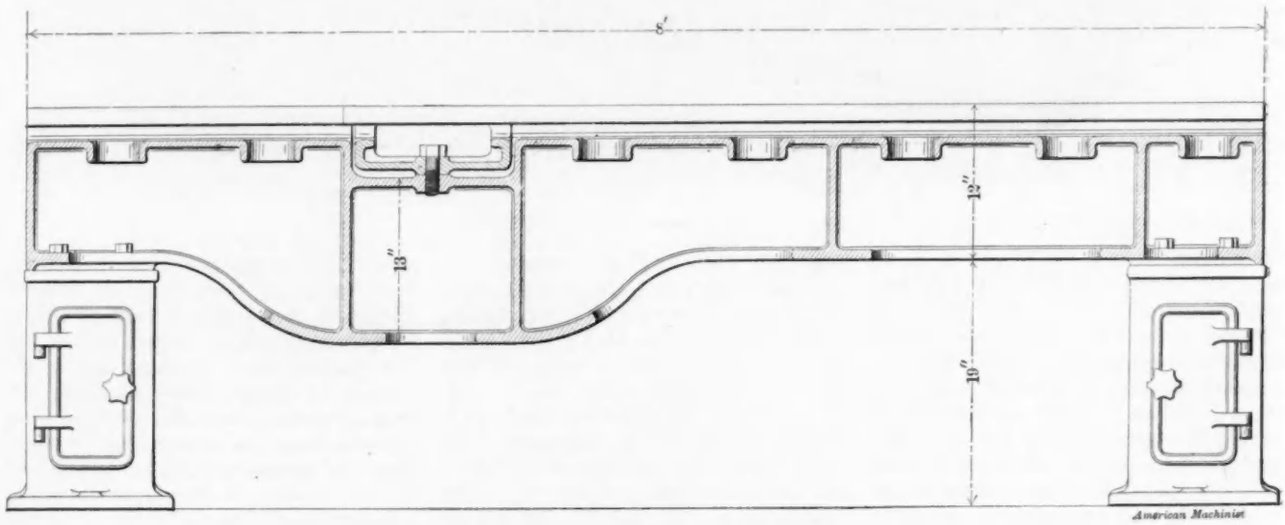
BY JAMES VOSE.

Sixteen-inch swing lathes, according to general opinion, are about the most useful all-round tools in the average machine shop, and basing his plans on the above opinion, Mr. John Tangye, who has over twenty years' practical experience in the designing and construction of machine tools, has commenced their manufacture at 106 Princess street, Manchester.

Notwithstanding the abuse sometimes leveled at them by persons who, in many cases, have never had the opportunity of experiencing their advantages, a well-made gap-bed lathe fills a useful position in even the best organized and equipped shop, and in the case of many small and medium sized shops is double the value to the user as compared with the straight-bed lathe; the extra cost in the first instance being only 3 or 4 per cent. of the price of the plain-bed lathe. Grasping this fact, Mr. Tangye is building lathes with either straight or gap beds, according to users' requirements. The design of the bed has come in for special study, and, as will be seen from the sectional views, the lathe saddle is exceptionally well supported in front, the bed not only being wider on top than is usual, but the extra width being added to the front, so that large face-plate or chuck work is handled under very favorable conditions. As will be seen, the continuous longitudinal web connecting the shears adds greatly to the torsion resisting powers of the bed. The bed, in fact, gives a very favorable first impression, and it was the seeing of a bed



A NEW ENGLISH ENGINE LATHE.



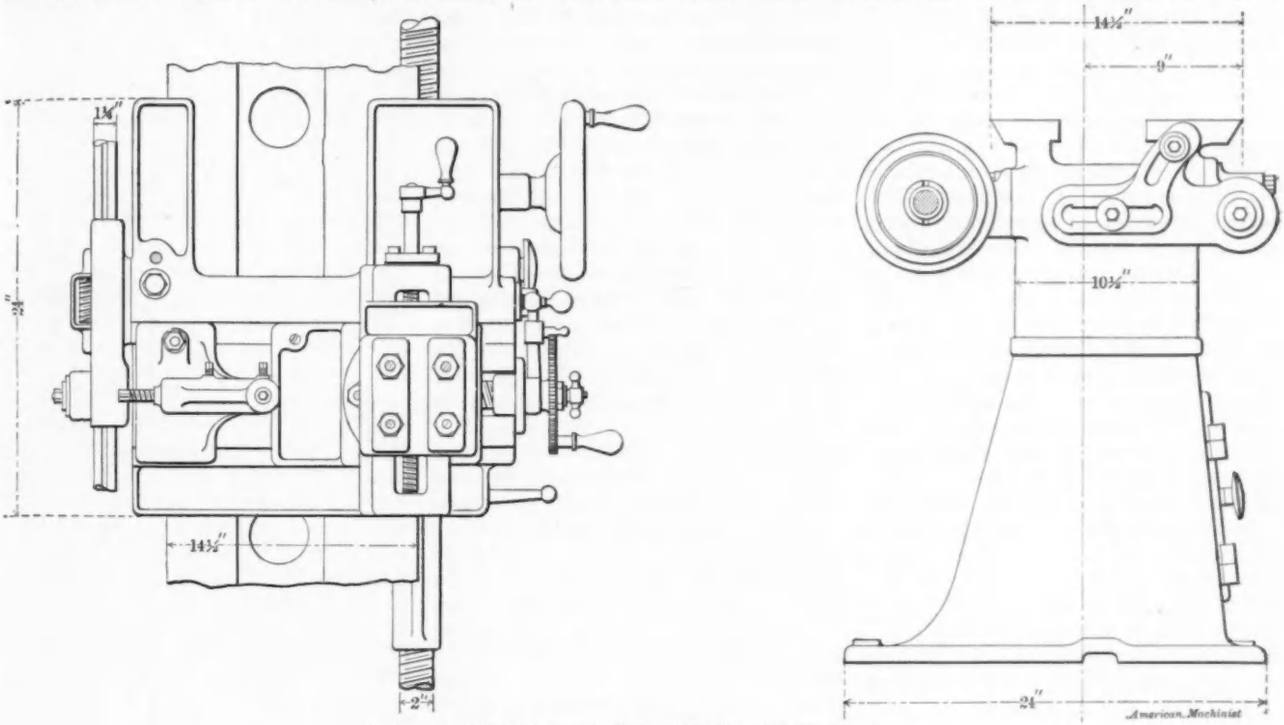
LONGITUDINAL SECTION OF TANGYE LATHE BED.

casting at the foundry that caused me to inquire who was manufacturing the lathe.

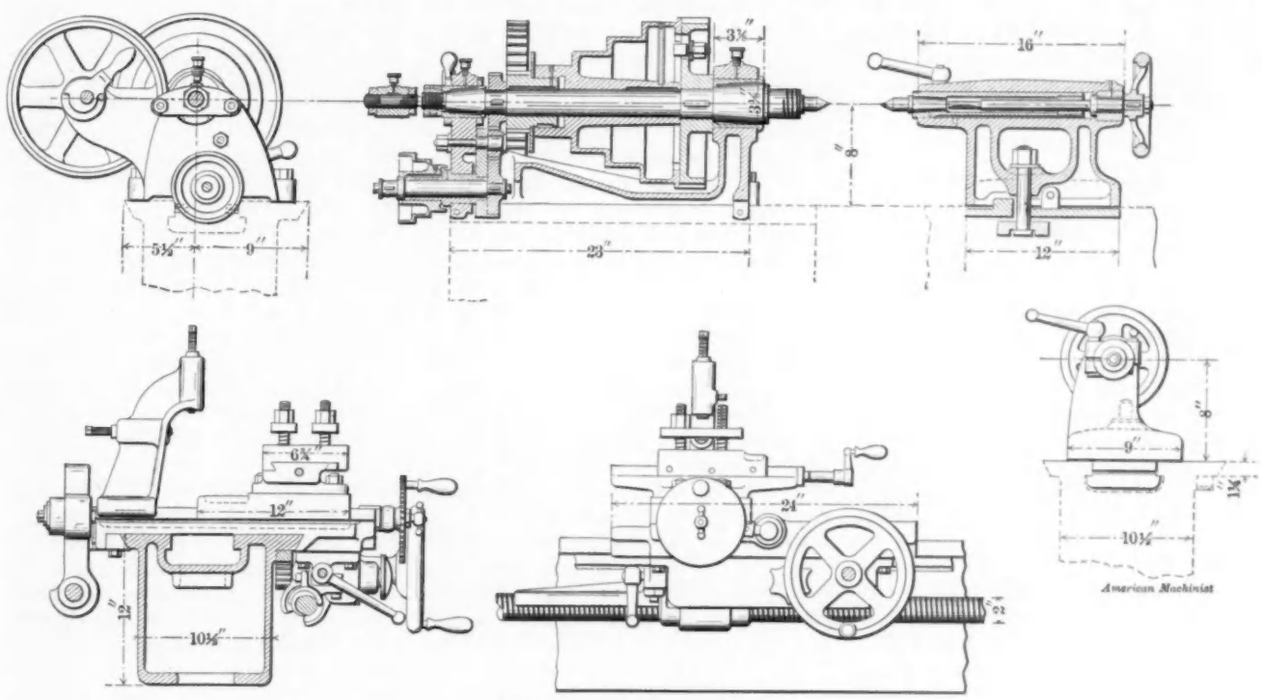
The influence of American ideas is to be seen in the cupboard standards, the webbed headstock, with the screw-cutting or feed reverse motion inside; the apron on carriage, and the small size and handiness of the change wheel quadrant. The lead screw is cut two threads per inch, which is vastly preferable in most English eyes to the finer pitches in vogue in America. Much coarser screws are commonly cut in English lathes than is possible in the American ones, and in this connection Mr. Tangye has taken pains to insure that the quick withdrawal motion fitted to the carriage transverse screw shall be thoroughly reliable and efficient. It is curious that certain districts in Great Britain are very fond of this feature, while in others its absence seems to occasion no regret.

The independent sliding and surfacing motions (carriage and cross feeds) may be driven by either belt or gearing, and the saddle and cross-feed slide are provided with locking arrangements independent of the gib adjustments. The tailstock is cut well away on the near side, so that the top rest handle may be used, English fashion, with comfort. It is a noticeable fact that recently almost all American makers have made this departure in their tailstocks, and the result is a great improvement in appearance and additional usefulness of the lathe.

The occasional benefit of the cross adjustment of the tailstock for taper turning is recognized, the screw cross adjustment being locked independently of the



PLAN OF CARRIAGE AND END VIEW OF TANGYE LATHE.



DETAILS OF TANGYE LATHE.

main clamp bolt. A small, though not unimportant point is attended to, *i. e.*, an oil cup is cast on the front end of the tailstock barrel, and fitted with oil pin, for oiling the lathe centers. The free use of Winkley oil-hole covers is also noticeable. The centers are Morse taper, which personally I think adds appreciably to the dividend-earning capacity of a lathe.

All the gearing is machine cut, the rack and small pinions being of steel. At the present time, in England, a very much larger percentage of machine-tool wheels are being cut than has ever been known before. Every shop adapted for wheel cutting is crowded with orders, and wheel-cutting machines by known makers are at a premium.

Mr. Tangye's countershaft has two pairs of pulleys, and the American round belt-shipping bar is used in conjunction with the hookplate and staple for wood handle. The belt bar arms and oil-catching dishes are adjustable, so that the hangers may be fastened to wall, ceiling or floor. The illustration, page 31, shows the lathe arbor arranged with conical journals running in phosphor-bronze bearings, a construction much appreciated in some districts for heavy and accurate work. Parallel journals and hollow spindle of generous diameter are, however, supplied, and a four or six tool turret rest may also be obtained as an extra. The main dimensions of the lathe are given in the sectional views, and, taken altogether, it would appear that the maker is to be congratulated on his initial efforts, an opinion shared, I believe, by the users of the tools already in use.

Manchester, England.

"Science" by Legislation.

We extract from the presidential address of Prof. T. C. Mendenhall, delivered at the recent meeting of the Society for the Promotion of Engineering Education, the following account of a remarkable incident, which needs no comment:

"We cannot ignore the fact that the general public, even the intelligent public, receives its information regarding scientific and technical questions almost entirely from daily newspapers and popular magazines, than which, we will admit, there could hardly be a more untrustworthy source. The widespread taste for sensationalism by which we are now cursed, a taste which seems to grow with the efforts made to satisfy it, offers a premium upon anything startling or revolutionary, giving little heed to sober, everyday truth. If one-tenth of the wonderful scientific discoveries that have been announced with glaring headlines in the public press within the last five years had *actually been made* it would, indeed, have been an epoch-making period; but, fortunately for everybody, they existed mostly in the brilliant imagination of the space writers, who alone were benefited by their publication. If this were all, we could afford to be indifferent, but there is the further disagreeable fact that a large number of intelligent people are led to look upon this sort of thing as real science and few of us have an adequate conception of the extent of this delusion. One of the results is that in science, as in many other things, those who do the real work of the world fail to be credited with it, while the people are lavish in their praise of those whom they *believe* to be worthy. Only a few weeks since I found in an article on teaching history, written by the superintendent of schools in a large city, the names of a quartet of Americans most distinguished in war and peace. Three of the four were Washington, Lincoln and Franklin. As this is not meant to be a humorous paper, I will not mention the fourth, contenting myself with saying that in this instance the newspaper had done its work well.

"A curious and, in my judgment, a seriously instructive example of the readiness with which people accept newspaper science is found in the attempt made a year or two ago to fix the value of the ratio of the circumference to the diameter of a circle by legislative enactment. This incident may be familiar to some of you, but it is entirely worthy of consideration by those to whom is intrusted a large share of the instruction in exact science in American colleges. The legislative body was not one of a State south of Mason and Dixon's line, nor west of the Mississippi river. It was a body chosen by the people of one of the greater States of the Union; one deservedly enjoying considerable distinction, especially in literary circles, on account of the eminent men it has produced and also for the excellence of its educational institutions. In this legislature house bill No. 246 was entitled 'A Bill for an Act Introducing a New Mathematical Truth,' . . . which truth, in the second section of said bill, turns out to be that the circumference of a circle is just 3⅕ times its diameter. In the capital of the State is published a daily morning paper of unusual excellence. Not generally given to sensationalism, its contents are usually clean and wholesome, its news well collected and arranged, and even a single copy gives the impression that it is an example of the better phases of journalism. Yet this paper devoted more than two columns of its first page to an exploitation of this most important discovery, which had been made by a physician living in an obscure corner of the State. It was announced that the laws of the quadrature had been copyrighted and that this newspaper was allowed to be the first to make them public, this privilege being, without doubt, the bait which caught the uninformed editor. Some measure of his credulity may be found in his sober declaration that the circle-squarer's demonstration had been accepted by all eminent mathematicians; that the 'American Mathematical Journal,' the highest authority in the country, had hastened to publish it, and this publication instantly attracted the attention of the scientific journals in Paris, the editors of which had eagerly sought contributions from the author of the discovery. The solution had been copyrighted in the United States and in England, Germany, Belgium, France, Austria, Italy and Spain. At Washington it had won the support of the professors of the National Astronomical Observatory, Prof. Asaph Hall, 'whose fame was secure with the discovery of the moons of Mars,' being specially delighted with it and finding in it a complete explanation of a hitherto unexplainable anomaly in the earth's motion. The desk of the discoverer was full of letters from leading mathematicians in Europe and America, and one from his agent in London proved that his demonstration had been shown to Tyndall and Huxley, who warmly indorsed its accuracy. Professors in Ann Arbor and Johns Hopkins University had seen the demonstration and declared it perfect. I leave to the guardians of the name and fame of these institutions and to others referred to the task of ascertaining just what lineal descendant of Ananias was at that time on the editorial staff of this journal, but the actual disposition of the bill by the legislative body is a matter of much interest. When first introduced it was taken humorously by the Speaker of the House, who happened to be a graduate of a widely known educational institution, and he ordered its reference to the Committee on Swamp Lands. Two days later, however, the great discoverer had a hearing before the State Superintendent of Public Schools and the Committee on Education, who at once indorsed the solution; the Committee on Canals and Swamp Lands reported House Bill No. 246 back, with a recommendation that it be referred to the Committee on Education; the latter committee gave the bill careful consideration and reported 'the same back to the House, with the recommendation that the said bill do pass;' the bill was called up by the committee and *mirabile dictu*, the bill actually passed that branch of the Legislature by what was reported to be a good, safe majority. Before it actually became a law, however, its character began to be recognized, and its further progress was arrested. The possibility of such an incident, at the very end of the nineteenth century, is a fact from which some useful inferences may be drawn and a just allotment of responsibility might well cause some anxiety."

The remainder of the paper was devoted to a presentation of the merits of the metric system. The author feels that the engineering schools are not doing their duty in promoting the adoption of the system, and urges his hearers to become more aggressive advocates of it.

Slot Machinery.

BY R. I. CLEGG.

That class of machinery in which you deposit a coin and obtain in return your correct weight, a sight of some model working, hear a popular air, get a stamped envelope, your photograph, liquid refreshment, kinetoscopic sights and phonographic results, etc., etc., has had a remarkable growth. In the earlier period of its history the purpose of the makers was blameless enough, but in these later days the machines have been adapted to cater to the wants of those who enjoy the "taking of chances." Accordingly, a numerous family of this type has come into being, and has flourished and fattened on the public purse, or, at least, the funds of that section of the public which needs considerable legal intervention and guidance to protect it from itself.

The coin-operated gambling machines are, of course, more numerous at those holiday resorts where the festive public enjoys recreation, and just as I write the papers are full of the doings of an industrious band of operators who have made the round of the slots and fed chunks of lead to the greedy mechanism, which was thereby induced to give up, eventually, its nickels in return. It is estimated that the harvest varied from $5 to $20 for each machine. Lest it may be thought this is too high an estimate, I copy the following from a Washington dispatch:

"It is proposed to place a stamp tax on all slot machines in which there is any element of chance. It has been found that the manufacture of these machines has attained gigantic proportions. In each of them the percentage of profit to the proprietor is enormous, and the tax would not be oppressive. Of course, this would not strike those machines which dispense chewing gum, for in them there is no element of chance, and the gum already pays a government tax."

I am somewhat interested in this subject, for a few years ago I had considerable experience with slot machinery, and well remember the several shrewd devices, regularly reported at the office, which were employed to beat the machines. The machines were not sold outright, but were put out on percentage, and thus each new device meant a fresh equipment in some detail or another for every machine on exhibition.

The sketch illustrates the coin attachment applied to the large exhibition models of machinery, commonly found in railroad depots and other public places a few years ago.

Fig. 1 is the side elevation; Fig. 2 shows the plan of coin cup or pocket, and Fig. 3 is an end view of Fig. 1.

Through the coin slot *c* the nickel *d* is dropped into the pocket *e*, and the lever *f* drops to the position 1 1. As may be seen best in Fig. 3, the pocket is cut down from top to bottom, so that the coin rests upon the top of *k* and the cup itself; *e* does not come in contact with *k* at any time, the latter sliding through the slot as the cup finally descends to force out the nickel.

When the lever *f* moves to 1 1 this frees the fly regulator *g*, which is driven by a worm gear in the usual manner, and the machine starts to do its allotted stent; the cam *i* rotates, moving the lever *f* to 2 2, ejecting the coin out of the pocket *e*, and when *h* passes off the point of the cam *i* the lever *f* drops, locking the governor *g* and bringing the machinery to a halt. Later, when electrical effects were sought, as the model of an electric lighting station, with steam engine driving dynamos and several glow lamps, a simple switch was substituted for *g*, the mechanism was run by motor and storage battery, the several circuits being so arranged that when the engine and dynamos moved off the lamps lit up in realistic style.

Originally the coin tube *c* was straight, and a strip of metal or cardboad, or even folded paper, could be inserted to depress the pocket, and the manufacturer, and start the machine free of cost. At *h* a hole is drilled, in order that the lever may be nicely balanced with fine shot to turn with a nickel and no lesser coin. A nickel with a hole in it for a string was occasionally employed, not only to work the machine without recompense at the sweet pleasure of the operator, and sometimes, too, the ingenious fisherman baited the coin with a coating of adhesive gum, or some other sticky substance, and thus armed, fished for the contents of the till. This nefarious enterprise was met by cutting the lower end of coin slot *c* as seen at *l* in Fig. 3, and slanting the slide *c* as in Fig. 1. When the coin and string dropped down the slot in Fig. 1 it took the direction shown by the dotted line, and the string passed through the slot *l*, Fig. 3. When an attempt was made to withdraw the string the coin would stay on the outside of *c* and remain in the case as a souvenir of the attempt. A lead blank of the same size as the nickel would drop in the pocket and move the lever in an orthodox manner. The cup was then cut down in hight, two little bars were fixed across the bottom and every care taken to prevent any binding or sticking either of coin or device generally. As the lever *f* was carefully balanced to the weight of a nickel, the lead slug would send down the cup with sufficient force that *k* would roll out the blank and the lever *f* would swing and stop the governor *g* at once.

As will be seen, the parts are capable of careful adjustment, and are of light, not to say frail, construction. Herein lay another chance for invention. One night I sat in the waiting room of a railroad depot waiting for my train, when a party of young fellows dropped in, and soon turned their attention to the slot machine, whose purpose was to grind out tunes at a cent apiece. A youthful member of the party declared he could get the music minus the money, and when put to the test worked his scheme for the entire series of some eight or ten selections. His method was simplicity itself, and consisted in raising one end of the case off the floor about an inch and then setting it down hard. The wings of the fly regulator are, for obvious reasons, made very thin and bend easily, and, at the corners that first strike the restraining lever *f*, are liable to curve backwards after being in use for a time. The pressure of the spring behind the worm gear was sufficient, when the case received a heavy jar, to force the lever up the inclined wing, and an occasional shake kept the thing going until the cam *i* held the lever away from regulator. Thereafter the collectors were told to keep an eye on the wings and give them a slight set in the other direction, though not enough to impede the ordinary action.

I have been told of an individual who tackled an automatic weighing machine, and is said to have weighed his entire fam-

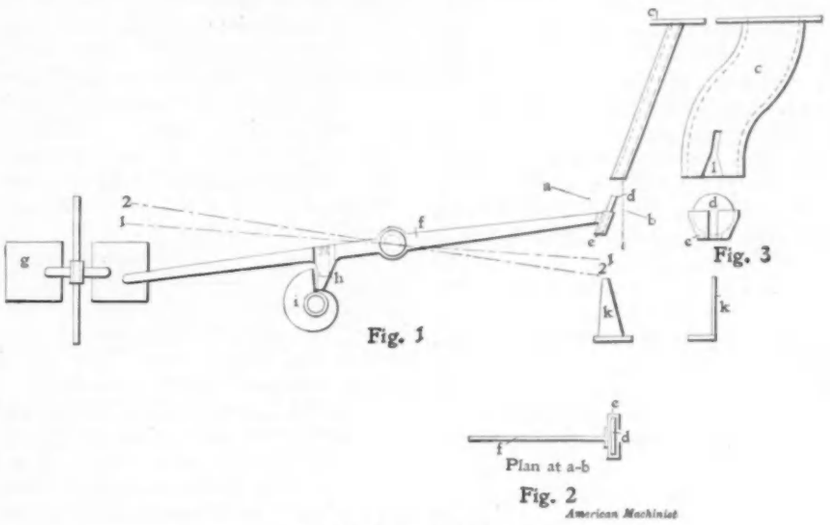


Fig. 1 Fig. 3

Fig. 2

COIN OPERATED DEVICE.

ily and himself on a single fare. First, he got on and was weighed; then, in rotation, the others got on and the heavier stepped off the platform. The descending needle on the scale would lock at each temporary increase of weight, but still moved and stopped to indicate the lighter weight left on the machine.

The fight between the manufacturers and those who struggle to get something at their expense is very much akin to the efforts of the ordnance experts who meet the improved gun with still better armored targets, and so on; and the story, *in extenso*, of the designers in both camps would be a long one indeed.

Providence, R. I.

Letters from Practical Men

Liquid Air for Automobiles.

Editor American Machinist:

In reading the paper this week I was astonished to see an article by Mr. Frank Richards on liquefied air, which you had published without comment.

In speaking of running a small tricycle by liquid air he does not mention the fact that liquid air cannot be kept, and therefore, in calculating the cost of the machine, you must figure on having a plant for the production of the liquid air near by, where you can obtain a freshly-made supply immediately before starting for a ride. The only way that liquid air can be kept is by allowing some of it to evaporate, and so keep the temperature of the liquid below its critical temperature, otherwise, it will all become again a gas.

But this is not the point of the article which is especially astonishing. The description of the engine with which he proposes to run his vehicle is what amuses me. He speaks of a .104 horse-power engine as sufficient to propel the tricycle over park roads at a speed of 8 miles per hour. By this, of course, he means on a level. We will suppose that he meets a slight up-grade, and that the speed is reduced to 6 miles per hour in mounting it, and for the moment we will not count friction or traction resistance. We may assume that the tricycle with rider and 50 pounds of liquid air will weigh at least 300 pounds. Assuming these conditions, let us see how steep a grade it would be possible to mount.

According to Mr. Richards' figures, he has $33{,}000 \times .104 = 3{,}432$ foot pounds per minute available. Dividing this by the weight of the vehicle and load, 300 pounds, we obtain 11.44, which is the number of feet per minute that .104 horse-power can lift 300 pounds. Now, dividing this by 528, which is the number of feet per minute that the cycle must travel to make 6 miles per hour, we find that the maximum grade that can be mounted is 2.17 per cent. Now, going through the same process again, only assuming that 10 per cent. of the power is used up in friction and 20 per cent. in overcoming the traction resistance, which are very conservative figures, we find that there is left .0728 horse-power, and this would carry the vehicle up a 1.5 per cent. grade.

Now, let us figure out the horse-power necessary to carry such a tricycle up a 10 per cent. grade at the speed of 6 miles per hour, which is the very minimum that a vehicle of that type should be able to do. Assuming, as before, that 30 per cent. is lost in overcoming friction and traction resistance, we find that .688 horse-power would be required, or nearly seven times as much power as Mr. Richards has given his machine, so that his 50 pounds of liquid air, instead of lasting him for a distance of 56 miles, as he assumes it will, would only last for about 8 miles, or a little over an hour's run.

Compare these figures with what is being done every day by gasoline vehicles, where three gallons of vaseline, at 10 cents a gallon, and weighing less than 20 pounds, will carry a machine and rider, weighing over 300 pounds, 100 miles at an average speed of 12 miles an hour, over country roads, and is then capable of being recharged at any country store in less than five minutes. I might add that it has been found necessary to use a 1¾ horse-power motor on the gasoline vehicle that I have in mind, and I do not think that Mr. Richards would have much success with one of less power.

EARL P. MASON.

To astonish and also to amuse a reader is not an everyday achievement of mine, so that Mr. Mason's letter above should afford me unusual satisfaction. My article, entitled "Liquid Air for Automobile Service," in the issue of August 10, to which Mr. Mason's letter refers, was intended to make out the best possible case for liquid air for the special service therein considered. It was not written in the interest of anything or anybody, but was intended solely to stimulate others to think about the matter and to study the possibilities of the case. The eliciting of honest and well considered criticism is one of the most legitimate and welcome results of my endeavors.

I am quite disposed to stand by my assumptions and deductions in the article referred to. Mr. Mason says that I do not mention the fact that liquid air cannot be kept, etc. This is absurd. Mr. Mason evidently did not need to be informed of this important fact. There is in New York city, as everyone knows, a plant for the production of liquid air in considerable quantities. As liquid air has been carried from New York to Boston, to Washington and elsewhere, a considerable portion of it surviving for exhibition purposes, it was not straining very hard to assume that it might be procured in New York for charging my vehicle immediately before starting upon my trip. I assumed that a liquid air supply service might be established, and that there might be three or four or a dozen judiciously distributed stations in the city, where daily supplies of liquid air might be stored, and where smaller quantities might be procured for immediate use, as, for instance, beer is understood to be used. I might, indeed, have assumed that my vehicle was charged right at the door of the liquefying establishment.

It may be well to say for general information, upon the word of the manufacturers of liquid air, that one gallon of liquid air may be so kept that it will not all evaporate in twenty-four hours, that ten gallons may be kept three or four days, with proportionately better results for larger quantities. In my computations I allowed a loss by evaporation of one-fifth of the charge with which the vehicle started. Whether this was sufficient could only be determined by actual experiment, but my allowance certainly showed that I had not ignored the matter.

But what Mr. Mason indicates as his principal contention has nothing to do with liquid air at all, but bears upon the general problem of the application of power to vehicle propulsion, and of the power required under given conditions. In my case I assumed the best city roads, asphalted and level, and I assumed that one-tenth of a horse-power (.104) should be a sufficient mean for the propulsion of a vehicle carrying only a single person of average weight. Mr. Mason assumes a total weight of 300 pounds, which I consider very fair. It is not necessary to go into figures upon this matter. Modern vehicles, under the stimulus and inspiration of the bicycle, show astonishingly small losses by friction. Anyone who rides a bicycle, even under conditions which are not always the best, knows how little power is required to maintain a speed of eight miles an hour. Putting the power of a man (in this case, of course, including woman) at one tenth that of a horse, and acknowledging that not one-half of a man power is usually required to propel a bicycle, my assumption of .104 horse-power, or one man-power, is evidently an ample mean, if properly applied, for the service for which I computed it.

Mr. Mason assumes, which I did not, that in the course of my trip some grades are to be encountered, and kindly computes for me that my mean power will be sufficient for a grade of 1.5 per cent., which would be equivalent to a rise of a yard to each of the short, numbered blocks of New York city. A grade as great as this is found only in a few portions of the city, and there are many of our cities, especially in the Central and Western States, where no such grades exist. Uphill work implies also an equal amount of downhill work, so that the mean power re-

quirement is not much affected by slight grades. But to maintain the mean power, when for some portions of the run no power is required, there must be provision for exceeding this mean at other portions of the run. It will be noticed that my assumed piston speed is only one hundred feet per minute. This, of course, may, when required, be at least doubled, proportionately increasing the power developed. In addition to this, my hints as to the design of my vehicle included "differential gearing of wide range." This is a necessity which is not yet sufficiently recognized by the designers of motor vehicles. Mr. Mason, in his discussion of the matter, does not seem to recognize the presence of this device in any way, and, singularly enough, while he attempts to figure that I have not power enough for slight hill climbing, he does not call attention to the insufficiency of torque for starting and for acceleration, where I would be more wofully deficient. By doubling the speed of the motor I would get double the power, which, with a suitable changing of gearing, would also double my torque at the normal vehicle speed. Further changes of the gearing ratio might easily give a much greater torque when starting and getting up to speed. This would, of course, mean a larger air consumption for the distance traveled, but as I only contemplated continuous running when once started, the allowance required is not worth considering.

I must distinctly decline to follow Mr. Mason into any consideration of 10 per cent. grades, as they clearly are not included in my assumption of smooth and level roads. We must all, however, thank him for the results of his computation. It is to me peculiarly gratifying to be assured that my charge of liquid air would carry me eight miles with a 10 per cent. grade all the way, or that while making the run at eight miles in one hour I would also ascend more than three-quarters of a mile.

Neither is it at all proper from the standpoint of my article to compare the liquid air vehicle with the gasoline vehicle as to cost of operation. The power cost is far from being the principal question to be considered. I made my vehicle one of pleasure, and compared the cost of its operation and maintenance with the expense of keeping a saddle horse. It, of course, can never be comparable, in cost of actual power developing material, with the gasoline motor. But there would seem to be other considerations to commend it which might far outweigh the power cost. The ease with which such a vehicle might be operated, and the entire absence of heat and smell and other annoyances might far outweigh the saving of a few cents per trip when pleasure and not profit was the controlling object. FRANK RICHARDS.

A Light Tapping Machine.

Editor American Machinist:

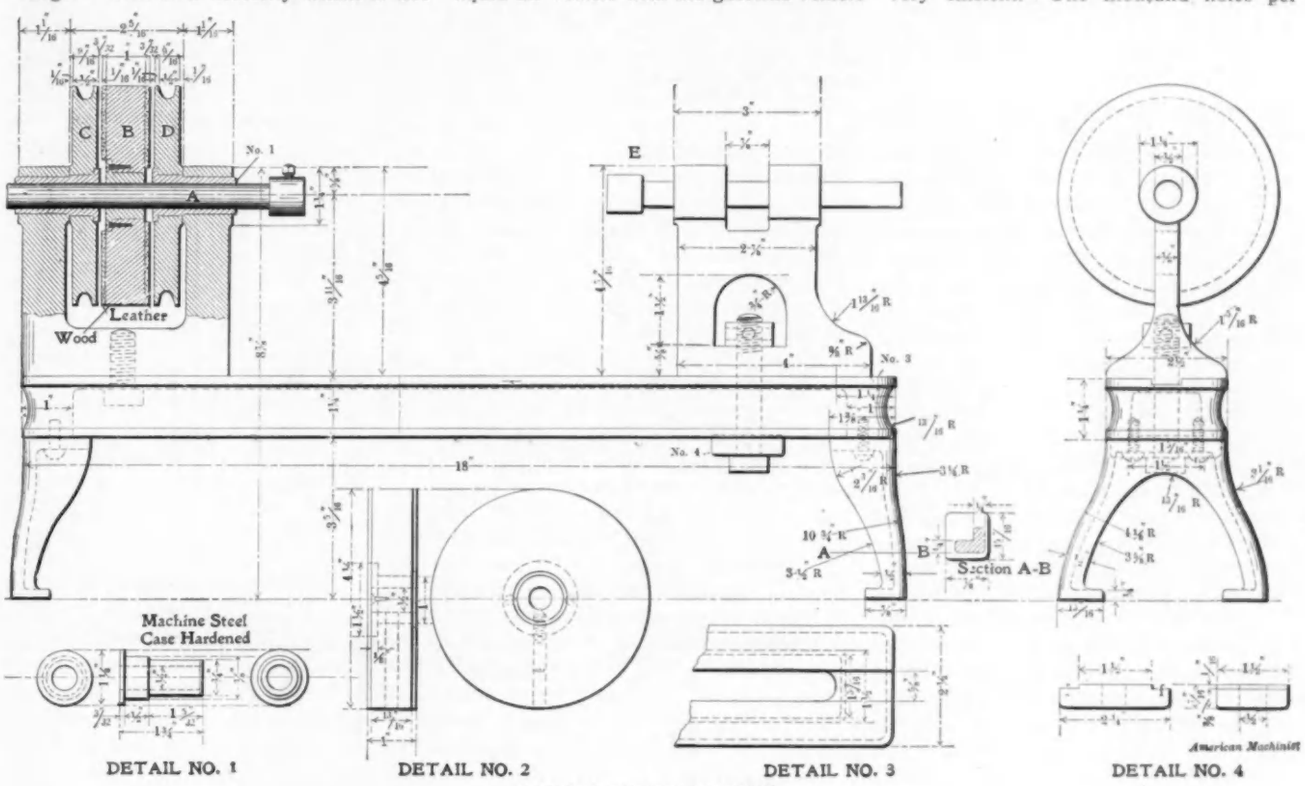
The accompanying drawings illustrate a bench friction tapping machine which is both sensitive and efficient.

A is the spindle to carry the tap; *B* a disk of wood faced with leather, on both sides, and fastened to *A* with iron flange and set-screw; *C* a sheave pulley, which drives *B* by friction contact, produced by pressure of work against tap; *D* a pulley which reverses *B* when work is withdrawn after tapping; *E* a dead spindle, to which is fitted a chuck to hold the work to be tapped.

A twisted rawhide belt is used, which can be adjusted to suit strength of tap, and allows tapping of holes to bottom.

For freehand and tapping to bottom in sizes up to No. 10 or No. 12 this device is very efficient. One thousand holes per hour are within the limits, the writer having timed an expert, who tapped 1,000 brass binding posts in fifty-five minutes.

A. J. STRONG.



FRICTION TAPPING MACHINE.

[Larger machines made on this principle are of course well known, but these usually have positive clutches instead of driving by friction.—Ed.]

Drill Blocks.

Editor American Machinist:

Wooden drill blocks, so commonly used for holding drills, are not what they should be. The figures denoting the sizes of the drills are soon obliterated, the holes become somewhat enlarged, one of the "cubs," or perhaps a jour., has jammed a No. 45 drill into the hole intended for a No. 46 drill, or it may be the drill has stuck fast in drilling, and a ridge or so has been formed on the shank by the rotation of the chuck, and when the drill is returned to the block it is, perhaps, put into the hole which it seems to fit, but

which is larger than the drill. Again, dampness causes the wood to swell, and therefore the sizes of the holes change, and even if the hole is of the proper size a drill will quite frequently stick, because the wood seems to adhere to it more firmly than a steel block would.

All these things cause trouble, but they can be avoided by having the block made of machine steel and drilling all of the desired sizes of holes .001 inch or .002 inch full. The sizes of the drills in thousandths, as well as the "number" sizes, should be marked just below their respective holes. The piece is then case hardened, and we have what I think to be a model drill block.

The drills should be placed in point down. Drills then cannot be put into holes of smaller diameter, and if put into those of larger diameter the shake, which is more appreciable in a steel block than in a wooden one, will make the misplacement more evident, and by putting them in point down burrs do not annoy us.

Apart from the blocks a quantity of drills of the different sizes must be kept in store, especially "number" drills, so that a drill .001 inch larger or smaller than the standard size may be picked out if desired, as the drills vary in size slightly. The most systematic method of keeping these is in a cabinet, similar to the spool cotton cabinets, which have shallow drawers with many compartments. These compartments may contain the drills according to size, and should be marked, like the blocks.

To determine the size of drill for a tap hole a convenient tool may be employed, which is made of a strip of machine steel about ½ inch thick, in which holes are tapped of any number of desired sizes of screws and properly marked underneath. The size of the drill to be used for drilling a hole for tapping may be marked below the size marked, as for instance,

No. 12 — 24 or ¼″ — 20
No. 11 No. 5

This is then case hardened, and enables one to quickly determine the size and thread of a screw, and also to know immediately the proper size of tap drill to be used.

EDWARD J. KUNZE.

Tool-Relieving Slotter Bar.

Editor American Machinist:

The accompanying sketches, showing this tool-bar in operation and the details of same, may prove of interest to many of your readers. It is not offered as something very new, though it has proven so to many of the visitors who have seen it in operation at the shops of the Niles Tool Works Company, and from the many letters of inquiry asking sketches and information of the same. Some other man may have something just like it, but, nevertheless, I will say this particular tool-bar is the idea of one of the Niles tool-room men, and has been in successful operation for many years.

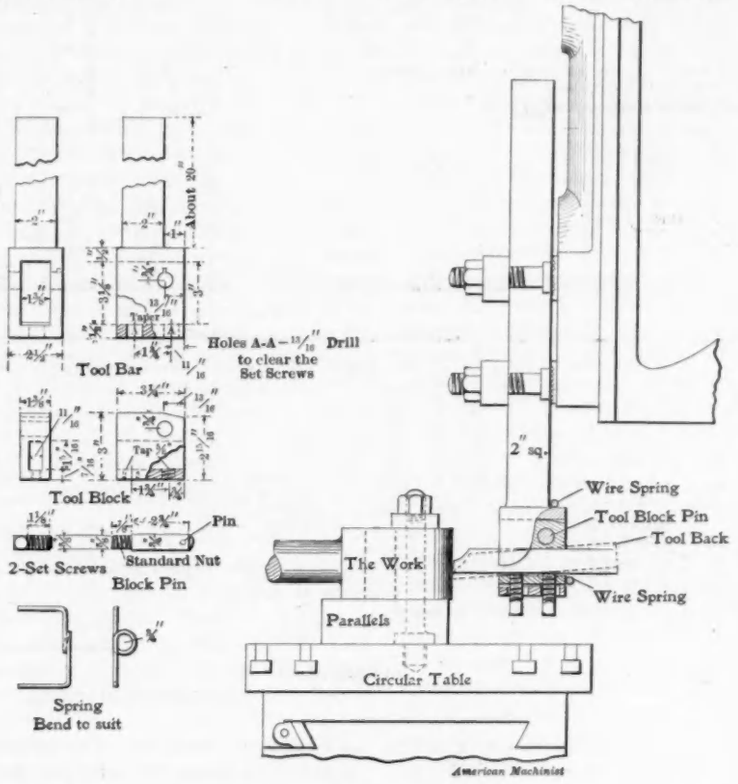
As readily seen, in operation the severe wear caused by the return drag of the tool is entirely removed, and, in addition, the bar gives the desired stiffness to the cutting tool, thereby insuring a more true cut on the work.

The tool-bar, as seen in the details, is very simple, and it certainly is a very useful adjunct to the slotters not already provided with the usual release tool-holder attached to the end of the ram of the modern machine tool.

WM. PILTON.

Hamilton, Ohio.

[In issue of January 21, 1888, we published a description and illustration of a similar bar.—Ed.]



TOOL-RELIEVING SLOTTER BAR.

Pattern Inspection.

Editor American Machinist:

The subject of the inspection of pattern work is one which I have never seen discussed in the columns of the "American Machinist," and I thought some of your readers might be interested to know how it is carried on in a systematic way by a large concern, and I hope my remarks will call forth some ideas from others.

Most of us know that the ordinary way of inspecting pattern work is for the foreman pattern-maker to take the pattern after it is finished and go over it to see if the draft and method of molding and coring are all right, and possibly he may measure some of the principal dimensions, but as a rule he does not haye the time to look carefully at every point on every pattern.

To inspect patterns in a systematic manner, it should be done by one man who makes this his special work. He should have a knowledge of pattern work and molding, and he should be a draftsman if possible, or at least he should be more in sympathy with the drafting office than with the pattern shop, so that if any mistake is found in a pattern, he may not be inclined to pass it simply because it will make a little extra work for the pattern-maker, but rather he should use his judgment to have it made in the way that will give the best results.

When the inspector receives a pattern, he should take the drawing and decide upon some point from which to make his measurements. If the drawing shows a center line, this will generally be a good point to start from. If the pattern has a similar center line on it, then he is ready to start his measurements; but if not, it will generally pay for him to take time enough to put one on, and he should ask the pattern-makers to leave all their center lines on the patterns.

Another important point is for the pattern-maker to put a line on the pattern showing where the casting will be finished. This saves time and annoyance to the inspector. It also shows at a glance how much finish has been allowed.

Having the center line or some other good point decided upon, the next step is to try the general or outside dimensions of the piece. After this take all the bosses and recesses, and, if the pattern is cored, then take the core box.

If some points are always borne in mind,

the inspector will rarely make a mistake in his work. Every piece or part of a piece has three dimensions, viz.: length, breadth and depth, unless it is a circular piece, and then it has two, viz.: diameter and depth. Also, every piece that is a part of another piece must have two dimensions to locate it by.

For instance, in Fig. 1 the letters *A*, *B* and *C* indicate the three dimensions referred to for every piece, and the letters *D* and *E* are the dimensions for locating it.

This will apply to any pattern, as one can readily see that, no matter how many bosses or recesses a pattern may have, each boss or recess will have these dimensions, and if they are all carefully measured there will be little chance for an error.

In inspecting a corebox it is best to first compare the core print on the pattern with

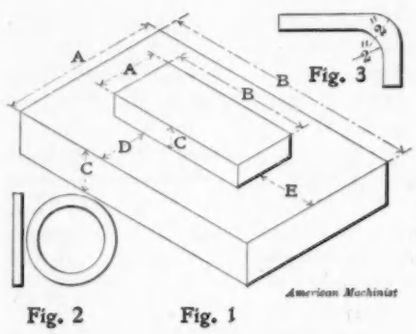


Fig. 2 Fig. 1

FOR INSPECTING PATTERNS.

the print part of the box, and then take the other dimensions from this. The corebox should never be any larger than the print on the pattern, and generally it is wise to have it a little smaller. In the case of cores about a foot square, if the box is from 1-32 to 1-16 inch smaller, it should be all right; but in cores 3 to 5 feet long, from ⅛ to ¼ inch should be left.

There are various reasons for leaving this amount of clearance:

First—A core is generally made of sand mixed with flour and molasses, and when put into the core oven to bake, it has something of the same tendency as bread, and rises and swells, which is the reason why no core can ever be put back into its box after it is baked.

Second—In setting cores of any size, it is necessary to do so with a crane, and with the core supported from the crane, and two or more men guiding it into its place, it is very nearly impossible not to strike the corners of the core against the mold, unless there is clearance.

I once saw a case which proved the above beyond doubt, at least to me. It was a large machine casting, and there were three cores, I think, each about 3 feet wide, to be set side by side. The pattern-maker had made his boxes ⅛ inch small, but when the molder tried to set his cores he found them larger than the space they were to fill. The coreboxes were finally made ⅜ inch small.

The inspector should have a set of tools that will help him in his work. Some tools that are out of the general order, and which are very useful are a set of rings, Fig. 2, from, say, ¼ inch to 6 inches, varying by eighths, quarters, or whatever the nature of the work seems to demand. These can be used for testing half-round coreboxes, parts of circles, etc.

Another set of gages that are handy is shown in Fig. 3. They are a set of external and internal corners, from ⅛ to 2 inches, varying by eighths, for measuring corners and fillets when it is desired to get them accurate.

The inspector should be called into the machine shop at any time when castings do not seem to come right. He should then take the pattern and see if the same trouble exists in that. If it does, he should then have it corrected, but, if not, he should inquire under what conditions it was molded, and if he finds the trouble, then he should put some kind of a notice on the pattern to inform the molder of the trouble, so that he can devise some way of getting better results.

In shops where there are to be a number of castings made from the same pattern, the inspector should examine the first casting. He should set it up on a surface plate (if not too large) and lay out the center distances and the amount of finish, also see that the clearances are all as the drawing calls for. This will sometimes save expense when a mistake gets by the inspector on the pattern, also some point regarding the molding may be noticed and improved.

H. DANFORTH.

The Dudgeon Steam Wagon—The First Roller Tube Expander.

Editor American Machinist:

Referring to article on the steam wagon, I might say that I was an apprentice in Mr. Dudgeon's shop when the wagon was built. Your article states that the boiler was made by Nichols, New York City. As I remember the matter, Mr. Dudgeon built it in his own shop. He certainly expanded the tubes, and while doing so he invented his expander. The tubes in that boiler were the first ever expanded with a roller expander. J. J.

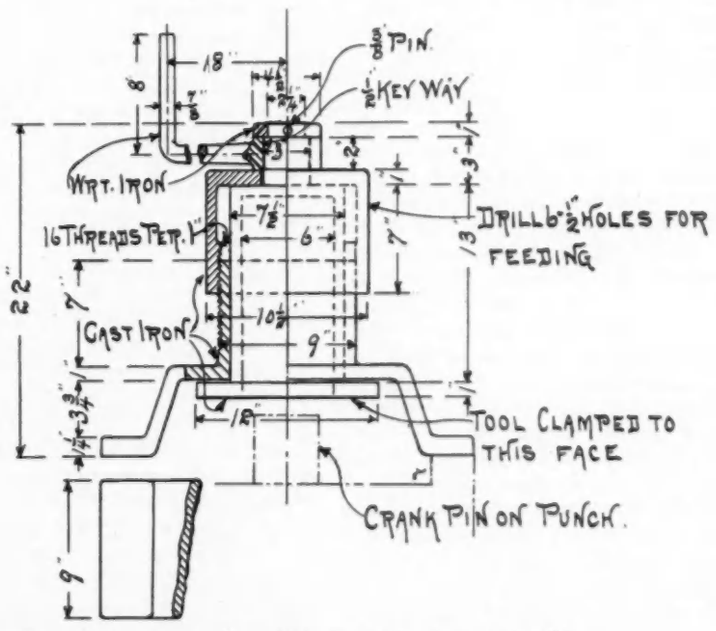
Hespeler, Canada.

Rig for Turning the Crank-Pin of a Punch—Dudgeon's First Experiments With the Hydraulic Jack.

Editor American Machinist:

The machine of which I send you a sketch was devised to true up the crank-pins of a large beam punch, the pins having been bent by requiring the machine to do work that was too heavy for it. It was a quicker job and did not cost as much as taking the machine apart and putting the shaft in a lathe.

Your article about the Dudgeon steam wagon brought to my mind a story of his first jack, as told to me by one of his shopmates, whom I worked alongside of at one time. The story was that they were working in an old machine shop up the Hudson (I think it was the Washington Iron Works, at Newburg). Dudgeon at the time was running a planer, and would work on his jack whenever he got a job that it took some time for a cut to go over. After the jack got far enough along he would go outside the shop in a stone-



DEVICE FOR TRUING CRANK PIN OF PUNCH.

yard and try it under some of the big blocks that were being squared up.

The device for reaming holes so as to bring them in perfect alignment, which you illustrated in issue of July 6, was designed by F. W. Morgol, the head of the tool room in the machine shop of the Maryland Steel Company, at this place. He has established quite a reputation for being able to think up a good tool whenever it may be required. A. H. NOURSE.

Sparrows Point, Md.

[The sketch referred to by our correspondent is here reproduced in *fac simile*, as a good example of a shop sketch embracing all essential particulars for a quick emergency job not to be repeated. The only details lacking seem to be the dimensions of the pin to be trued up, which must have been about 4 inches diameter and 4½ inches long. The standard or main casting was evidently clamped to the front of the punch frame. The tool used for the cutting was probably fastened to the face of the revolving carrier by two or three countersunk screws, the cutting lip projecting a little beyond the body of the cutter. The making of the rig, of course, took considerably longer than the doing of the job, but we can easily believe that it was still cheaper than pulling down the punch and getting it together again right.—Ed.]

A Job of Curved Planing.

Editor American Machinist:

I think I recognize in the letter of Mr. Brown, published in your issue of July 31, a job of tooling the surfaces of lever arms which hold the paddles of a feathering paddle-wheel, and the method described for doing it is certainly very efficient, unless one should happen to have a boring and turning mill, on the table of which these arms might be clamped, in which case, of course, they could have been done much faster, but it would have taken a mill of about 24-feet capacity, and such mills are not so common in machine shops as are two contiguous planers, which can be used in the way described.

May I venture to call attention to the fact, however, that almost anything would have answered for an outboard support for the 6-inch bar of iron, as very little stress would come on that end of it, and especially so if the clamps used to drive the bar had been put nearer the end of the bar to which the tool was attached. By placing these clamps quite close to the tool the cutting speed would have been nearer that of the planer instead of being considerably above it, and the pressure brought upon the pivot of the bar would in that case have been almost nothing, and a relatively light support attached to the floor would have answered the purpose; although, of course, where it is certain that the extra planer is not to be used for anything else, then that is a convenient way of holding the bar. S. T. FREELAND.

Unsatisfactory Condition of Some American Machine Tools Received in England — Complaints of Great Delay in Delivery.

I think it wise to call attention to one great danger which at present threatens the position of the American export trade in the United Kingdom—and indeed I may say in Europe generally—so far as the machinery and allied industries are concerned. I refer to the condition in which American machinery and machine tools are being received in this country. Up to about a year ago it was the exception for an importer on this side of the Atlantic to receive from America a consignment of badly finished goods; but I regret to say that lately a very great deal of that shipped has been badly finished and altogether unsuitable for sale. People who know what American workmanship can do naturally feel disappointed, and often disgusted to have such specimens sent them as have reached here lately. Of course the reason is that your makers of machine tools and allied industries are so busy that they are not stopping to do the work properly. Shipments thus received have been and are being returned to the United States, utterly rejected by buyers in this country. I may as well say quite clearly that if American manufacturers pursue the same course as they are now following in this respect, they will quickly lose their trade here and also their reputation. You know how difficult it is when once a country has got a bad name, to clear away that bad impression. American machinery has only sold here because of its better finish and general superiority to the same class of goods made here; and if you lose that position, you might as well give up the market here at once. It would be much better for American exporters to refuse to execute orders, if they are too busy to do themselves credit. At present many of them are simply damning themselves in the eyes of British buyers.

People who know the history of American trade in this country know full well what prejudices American manufacturers have had to surmount before they could get a hearing, much less a trial for their machinery in Britain. Twenty years ago the majority of British firms would not hear of buying American "jim-cracks," as they called your machine tools.

If your makers had been content with shipping second-rate goods or badly finished specimens of their craft, I need hardly say that your trade with England would not have attained its present large proportions. On the other hand, American manufacturers sent us their very best lines, and their manifest superiority simply overcame all insular prejudices. It would be a real pity if that well-earned reputation were lost because of the action of some break-neck exporters who apparently have too much to do, and who are sending out goods that do not reflect any credit on their country.

And then, too, as regards time of delivery of goods: Some of the importers of your machine tools have been waiting six and nine months over the time specified for delivery. Perhaps when they do get the goods and send them on they will be returned, as one can hardly be expected to wait six and nine months for important tools. It was not so very long ago since the trade papers were full of the smartness of American firms in executing prompt delivery, and that, too, has had no little influence on the expansion of business, especially during the last two or three years. Superiority of finish and quick delivery have been two main factors in promoting your trade here. If those advantages are withdrawn, then your exporters might just as well leave this market alone.

I have taken this opportunity of calling attention to a matter of really vital importance to American export trade. That branch of your trade may not perhaps be so profitable to you now, while the home trade prices are so high. But that boom is only temporary, while the foreign trade is a permanency. If I might venture a suggestion, it would be to keep a good foreign connection, even at the expense of a slight loss on such trade just now. If your dealers let go their hold of European business, they will find it impossible to pick up the thread of their connection in a year or two's time when necessity drives them into the foreign markets again. Above all, I would earnestly entreat your manufacturers not to cut their own throats by sending out anything of an inferior character, no matter how great the pressure on the factory may be. More damage is done to your trade in one month by that policy than you can repair in twelve.

Having brought these facts to the attention of your readers, it is to be hoped that the suggestions which I have ventured to make will be duly considered. I have on several occasions given, in these columns, particulars of many foreign markets requiring American manufactures, and it would be the greatest pity imaginable for your exporters to lose very promising outlets through rushing their goods out of the factories in an unfinished condition.

London. F. C. C.

On September 2 bids were opened for the fourth time for the construction of the ordnance shops at League Island Navy Yard, previous bids having been rejected as too high. The bids last opened were higher than before, and only one bidder submitted figures for the entire work, his bid exceeding the appropriation by $10,000. With the cost of labor and material going up, the only way to meet it is to increase the appropriation. Cutting down the designs, as is talked of for the Brooklyn shops, is folly.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming Lathes. Mer. Mach. T. Co., Meriden, Ct.

Punches & dies. Wal. M. Wks., Waltham, Mass.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 8.)

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J. L. Lucas, Bridgeport, Ct. Send for index sheet.

Wire springs and wire novelties of all kinds, to order, by Excelsior Wire Works, Clyde, O.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

Reliable persons of mechanical or inventive mind, desiring a free trip to the Paris Exposition with salary and expenses paid, should write The Patent Record, Baltimore, Md.

To take the place of T-square, we make fittings which you can apply to your drawing-board; great thing for large boards; send for circular. Leighton & Wisner, Watertown, Mass.

Wanted—Second-hand power belt bending rolls, from 8 to 12 feet between housings, also shear and punch; furnish all particulars, stating prices and weights. Address P. O. Box 1815, New York.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

A fully equipped modern plant, manufacturing exclusively a line of small machine tools, ranking at the top of their class—a clean, well-established, profitable business located in Philadelphia, but could be removed to any trunk-line point without injury to its trade—is offered for sale at a bargain; inventories over $25,000; an excellent opportunity for securing a desirable addition to any machine shop or iron foundry business, or for a machinist or office man to step into a business already made. Address Box 261, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

For assistant supt., master mechanic or chief draftsman, address Box 269, AM. MACH.

Wanted—Situation; competent mechanical draftsman; detail work preferred; references. Box 267, AMERICAN MACHINIST.

Tool-maker and technical graduate, speaking and writing English, French and German, wishes to enter a drawing office. Box 266, AMERICAN MACHINIST.

Wanted—Position as superintendent or general foreman, by a strictly practical man; 18 years' experience building machine tools in good shops. Box 265, AMER. MACHINIST.

Manufacturers—Are you dissatisfied with the management or output of your shop, or contemplate a change? Do you wish to systematize your shop on a modern basis? Address Box 263, AMERICAN MACHINIST.

Position as superintendent, assistant or master mechanic in manufacturing concern; thorough experience in plant construction and operation; technical graduate; would invest some money. Box 222, AMER. MACHINIST.

Desire to assist superintendent; am a persistent cost-reducer; thorough systematizer; not a machinist, but good mechanic, now working along these lines; want change; East preferred; shall we talk it over? Box 264, AMERICAN MACHINIST.

Wanted—Position as salesman; well acquainted with all manufacturing companies and hardware stores in New England, New Jersey and New York, and some in the South; machinist, and have had years of experience in introducing new goods. Box 262, A. MACH.

Wanted—Position as manager or superintendent, in America or Europe, by an American who has had experience in organizing and systematizing, also in cutting costs, and is conversant with first-class shop practice; correspondence solicited. Address Box 244, AMERICAN MACHINIST.

Help Wanted.

Wanted—Three first-class tool makers on interchangeable work. The Blickensderfer Mfg. Co., Stamford, Conn.

Machinists wanted; one or two first-class turret lathe hands. Apply to The Atlantic Works, East Boston, Mass.

Wanted—Instructor in machine work and machine design; graduate with shop experience preferred. Box 256, AMER. MACHINIST.

Draftsman wanted, well up in heavy machine tool design and plant reorganization. Address International Power Co., Providence, R. I.

An instructor in free-hand and mechanical drawing, at the Rose Polytechnic Institute, Terre Haute, Ind. Apply at once, with references.

Wanted—A machinery salesman to sell for an old-established machinery manufacturer; in reply give age and experience. Box 257, AMERICAN MACHINIST.

Wanted—Four draftsmen on mill work; good wages will be paid competent, experienced men. Address The Edison Portland Cement Co., Orange, N. J.

Wanted—Foreman for machine shop in New York; medium and heavy work; state age, experience and salary. Address Box 268, AMERICAN MACHINIST.

A good mechanical draftsman wanted for a position in the country. Address, stating experience, age, references and wages expected, Box 230, AMERICAN MACHINIST.

Wanted—An experienced special tool designer and draftsman for work on small special tools and instruments; state experience. Address Box 258, AMERICAN MACHINIST.

Wanted—A competent mechanical draftsman; one with experience on printing presses preferred. Address, stating experience, wages and references, "Press," AMER. MACHINIST.

Machinists Wanted—One lathe man, several floor men; light machinery; country town 25 miles from New York; steady work for good men. Address Box 224, AM. MACH.

Wanted—A mechanic who thoroughly understands gear cutting on Fellows gear shaper and Gould & Eberhardt automatic; steady position; state experience and wages. Address Box 259, AMERICAN MACHINIST.

Wanted—First-class lathe, planer and vise hands, in modern tool factory located near Milwaukee; good opportunities for the right parties. Write, stating age, experience and wages expected, to Box 260, AMER. MACH.

Machinists and tool-makers wanted; apply giving full particulars about experience, age, wages and references; permanent job; location two miles north of New York City. Ward Leonard Electric Co., Bronxville, N. Y.

Wanted—A working foreman for brass works employing six machine hands; one accustomed to handling general run of small modern tools preferred; salary $100 per month to right man. F. H. Koretke, 922 Magazine st., New Orleans, La.

A man to make estimates for a shop engaged in light contract work; competent machinist preferred; must have worked in a prominent shop in a similar capacity; state age, experience, references and salary required. Box 231, AMERICAN MACHINIST.

Wanted—Competent field foreman for erecting pen-stocks, water towers, tanks, steel stacks, etc.; man must be expert at handling men and rigging; monthly salary and no

(*Continued on page 40.*)

The Stationary Engineers.

At the annual convention of the National Association of Stationary Engineers recently held in St. Louis the following officers were elected: President, Herbert E. Stone, of Boston; vice-president, P. E. Lehey, of New York; secretary, George Van Tassel, of Chicago; treasurer, Dan Delaney, of Cincinnati; conductor, C. C. Elsasser, of San Francisco; doorkeeper, C. E. Fellows, Houston, Texas; chairman of the arrangements committee, Frank Eardley, of St. Louis, Mo. The next convention is to be held at Milwaukee on the first Tuesday in September, 1900.

Personal.

John Fritz, Bethlehem, Pa., was elected an honorary member of the American Society of Civil Engineers at the meeting of the Board of Direction held September 5.

Mr. John A. F. Aspinall, general manager of the Lancashire & Yorkshire Railway, has recently returned to England, after having spent some time on this side looking into American railway matters.

Mr. Gus C. Henning sails to-day, 14th inst., per S. S. "Columbia," for Europe, to attend the Council Meeting of the International Association for Testing Materials, to be held at Dresden, Germany, September 24.

Mr. John Kyle Holloway, vice-president of the Fosdick & Holloway Machine Tool Company, Cincinnati, sailed for Europe on the 12th, and will be gone for some time, looking into the matter of European trade in radial drilling machines.

Mr. Paul H. Wade, who has for some time been attending to the advertising business of J. H. Williams & Co., of Brooklyn, N. Y., and has made a great success of it, will henceforth devote his entire time to similar work for other firms in addition to the one named. His address for the present will be in care of J. H. Williams & Co., 9-31 Richards street, Brooklyn, N. Y.

Obituary.

Joseph Berry, a well-known machinist and tool maker, died at Dayton, Ohio, August 12. At the time of his death Mr. Berry was assistant foreman of the brass department of National Cash Register Company's factory.

John H. Sessions, president of the Sessions Foundry Company, Bristol, Conn., died September 10, seventy-one years old. Mr. Sessions had acquired wealth, principally as a manufacturer of small hardware, the large foundry having been conducted from the beginning chiefly by his sons.

Charles Yandes Wheeler, president of the Firth Sterling Steel Company, died in this city September 5, fifty-six years old. Mr. Wheeler was born in Greencastle, Ind., his father having been president of

Ohio Wesleyan University. He invented the projectile now used almost exclusively in the United States Navy.

Frederick C. Wells, a Chicago manufacturer of steam pumps, died at Wheaton, Ill., August 28, sixty-nine years old. He was a native of Connecticut, and went to the then West in 1849 as an engineer in the construction of the Illinois & Michigan Canal. Then he made money as a wholesale shoe dealer, but had been making pumps for the past thirty years.

W. W. Dodge, treasurer of the Dodge Manufacturing Company and president of the Western Gas Engine Company, died at Mishavaka, Ind., September 1, thirty-six years old. Mr. Dodge was a younger brother of the original patentee of the Dodge wood split pulley, who died five years ago, and he had been connected with the company since its organization.

Charles Lukens Bailey, one of the principal iron manufacturers of Central Pennsylvania, died at Harrisburg, September 5, seventy-eight years old. His father entered the iron business in 1838, and the son became his clerk and later a partner. In 1852 Mr. Bailey with Morris Patterson founded the Central Iron Works at Harrisburg. In 1866 he erected the Chesapeake Nail Works at Harrisburg, and in 1877-78 the present Central Iron Works.

The builders' trial trip of the new battleship "Alabama," which occurred on August 29, shows her to be the fastest of her class in the United States Navy. A speed of 17.25 knots was attained, while the contract calls for 16.

Manufacturers.

The Albany (N. Y.) Railway Company is to erect a new power house.

It is reported that the L. S. Starrett Company may locate their new factory at Waltham, Mass.

The factory of Oliver Bros., Lockport, N. Y., was recently burned, entailing a loss of about $200,000.

The Eddystone Manufacturing Company, of Chester, Pa., contemplates making an addition to its plant.

The Spencer Wire Company, of Worcester, Mass., has obtained permit for the erection of a new wire mill.

The Universal Lock Company, Woodbine, N. J., are just placing an addition, 122x36 feet, to their plant.

Robert Litle, of Philadelphia, has secured some property in Chester, Pa., and will start an elderdown factory.

Work has commenced in building the first of the additions to the plant of Milwaukee Harvester Company, Milwaukee, Wis.

The Lookout Sewer Pipe Company, whose plant at Chattanooga, Tenn., was recently destroyed by fire, has decided to rebuild a larger plant at a cost of $75,000.

The Hampden Knitting Mill Company, of Reading, Pa., are contemplating making extensive additions to their plant on Eleventh

(*Continued on page* 41.)

Help Wanted—Continued.

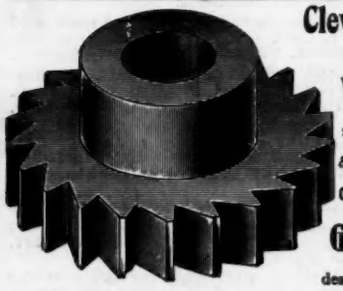
lost time to right party; write full particulars. Struthers, Wells & Co., Warren, Pa.

Wanted—A thoroughly competent foundry foreman, for foundry employing 75 molders, on general machine and power-transmission castings; in answering give full particulars as to past experience; state age and salary expected; first-class position for first-class man. Box 251, AMERICAN MACHINIST.

Wanted—Salesman; must have had practical experience in all kinds of heat transmission by steam and feed-water heaters, radiators, condensers, evaporators, coolers, etc.; furnish references as to capability, character and experience; state salary expected. The Heat Transmission Co., 28-38 Maple ave., Danbury, Conn.

Wanted—First-class man, not over 45 years of age, as superintendent of an old-established manufacturing concern, located about 50 miles from New York City, employing 500 people, engaged in brass goods manufacturing; must understand modern factory methods. Apply by letter to Box 214, AMERICAN MACHINIST.

Wanted—An apt and active young man with some machine-shop experience, also some experience in drafting, who wishes to rise as a draftsman, to do drawing on first-class machine-tool work; a good opportunity to right person. Address, giving particulars with reference to himself, Box 255, AMERICAN MACHINIST.



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GEARS of all descriptions.

We Make a 15-Inch Universal Monitor,

fitted with Friction Back Gears, Chaser, and with Set-over and Swivel to Turret. The turret is revolved by hand, and is provided with both lever and screw feed; has also a swivel adjustment, and screw cross feed for facing work. The chasing apparatus is arranged to cut both straight and taper threads, and has our improved follower, which can be made without a hob. Hadn't you better send for our free catalog.

The Windsor Machine Co., Windsor, Vt., U.S.A.

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CONSULTING ENGINEER,
OFFICE HRS. 2 TO 5 P.M. 921 CHESTNUT ST., PHILA.
Special Hydraulic Machinery, Difficult Mechanical Movements, Development of Inventions and Preparation of Patent Claims.

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We send the Cross Oil Filter on approval to prove our claim that it reduces oil bills 50% or more. You send it back if you don't want it. That's fair, isn't it? Capacities, 3 to 150 gallons daily. Write for Booklet.

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Largest manufacturers of Oil Filters in the world.

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For Advertisement of
TIGHT JOINT CO., New York,
See Issue Sept. 7, 1899.

"The Reeves" Wood Split Pulley,

with interchangeable bushing system for belt power transmission.

Lighter than an iron pulley. Stronger than a steel pulley. Each pulley will fit thirty-five sizes of shaft. No set screws. No keyway. Complete stocks carried in every jobbing center in the United States. Also

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Australian Agents, John Danks & Son, Pty., Ltd., Melbourne, Australia.

Reeves Pulley Co., Columbus, Ind., U. S. A.,
Send for Catalog. Manufacturers.

Each Ball In a Ball Bearing

Must be just like every other ball in the same bearing or there's trouble ahead. A ball that's larger than its fellows bears more than its share of the load, and is likely to wear unevenly or to break, thereby defeating the purpose for which it was intended, and increasing friction instead of reducing it.

We make balls for machinery bearings. We make all sizes, but only one quality—the very best. Every ball we make is perfectly round, and all of a given size are alike, within an infinitesimal fraction. No better balls are made—no better can be made by any known method.

Write to us. Our wide experience is at your command.

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A Bit of Logic:

We Claim that our files are considerably better than our competitors' in four points: High Carbon Steel used; Hardness and Thoroughness of Temper; Sharpness and Strength of Teeth; Uniformity.

Now it is a Fact that our production and sales are more than twice as large as those of any other file manufacturer anywhere.

Isn't there some connection between these two paragraphs? Doesn't it prove something as to Quality?

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SOLD all OVER the WORLD.

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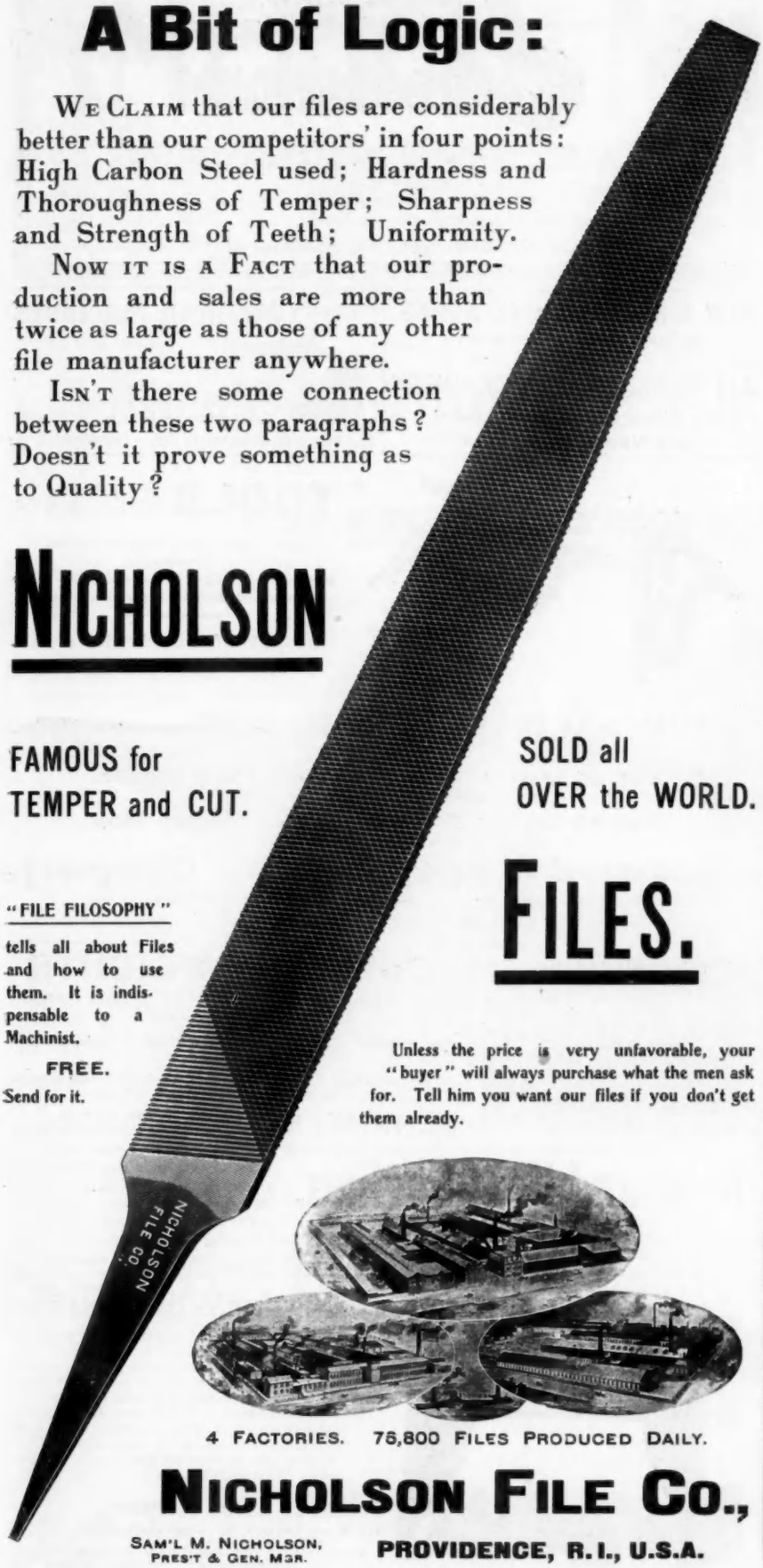
"FILE FILOSOPHY"

tells all about Files and how to use them. It is indispensable to a Machinist.

FREE.

Send for it.

Unless the price is very unfavorable, your "buyer" will always purchase what the men ask for. Tell him you want our files if you don't get them already.



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SAM'L M. NICHOLSON, PRES'T & GEN. MGR.

PROVIDENCE, R. I., U.S.A.

LARGEST FILE MAKERS IN THE WORLD.

(*Continued from page* 40.)

street, near Spring, and will erect a brick and iron structure, measuring 85 by 110 feet.

E. A. Schumacher and F. W. Boye, Jr., have formed a partnership under the name of Schumacher & Boye, having acquired the entire interest of the firm of Dietz, Schumacher & Boye, Cincinnati, Mr. Jacob Dietz having retired from said firm.

The Birmingham (Ala.) Cast Iron Pipe Company has just been organized, and a new plant capable of producing 100 tons per day will be erected near Birmingham. Mr. J. R. P. Dinimick, formerly of the United States Company at Anniston, is interested.

Hon. E. A. Wheeler and W. W. Shilling have secured a location in Sharon, Pa., and will at once begin the erection of a plant for the manufacture of the Wheeler tubular boiler. They are the sole owners of the patents. About seventy-five hands will be empoyed. The plant will cost about $50,000.

The officers of the Roane Iron Company, who own the large furnaces at Rockwood, Tenn., have announced they will soon begin the erection of another furnace at that place. The company will expend $200,000 in improvements, which will include the erection of this furnace. Modern machinery will be put in.

The new foundry for the Benjamin Eastwood Company, at Paterson, N. J., is nearly completed. The building is designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn. It is 92 feet wide and 180 feet long, with a traveling crane, the wings of the building being controlled by jib cranes.

Contracts were let recently for the construction of a building at the junction of Lottridge street and the Grand Trunk Railway, Hamilton, Ont., to be temporarily occupied by the Edgerton Storage Battery Company. As soon as all arrangements are completed a larger building will be erected, and it will be used as the main factory.

There are bright prospects that a large open hearth steel plant will soon be erected by the Pottstown (Pa.) Iron Company, and the blast furnace, which has been idle for many years, be again put in operation. An effort is being made by the company to raise by subscription from its present stockholders the sum of $1,000,000 for the proposed improvements.

Pittsburgh capitalists are engaged in erecting a large manufacturing plant at a point between Beaver and Vanport. Attorney W. S. Miller, of Pittsburgh, Pa., has had charge of the enterprise at that place and has secured options on several valuable farms in the vicinity. A corps of engineers is now on the ground making surveys and laying out the plant.

The directors of the Scott-Janney Electric Company, Philadelphia, Pa., met recently and completed the organization of the concern by the election of the following officers: President, William S. Janney, Philadelphia; vice-presidents, Charles W. Drake, New York; Edward A. Abbott, Concord, N. H.; chief engineer, Gordon J. Scott, Philadelphia; secretary, Charles F. Walter, Philadelphia; treasurer, Jacob Janney, Philadelphia.

The Henri Nestle Company, manufacturers of Nestle's food, are establishing a large plant at Fulton, N. Y., for the production of their specialties in the United States. This firm has its headquarters at Vevay, Switzerland. The plant at Fulton, N. Y., will be fireproof and of the most modern construction, using steel framework for the floors and roofs, with brick side walls, the floors being constructed of concrete supported by steel beams. The Berlin Iron Bridge Company, of East Berlin, Conn., furnished and erected all

the steel structural work connected with this building, under the supervision of Mr. H. J. White, consulting engineer for Henri Nestle.

Armion Schotte, Pittsburgh, Pa., engineer of the Herman Building, is engaged on plans for quite an extension to be made to the plant of the Baker Forge Company, now located in Allegheny, Pa. This plant is to be moved to Rankin station on the Baltimore & Ohio Railroad. One building, 60x80 feet, will be erected, in which will be placed the forges and blowers. A power house of the same dimensions will be put up, and a large addition will be made to the winding department. The output of the entire plant will be increased. One important change to be made by the Baker Company is the substitution of gas for steam engines, as the motive power will be supplied entirely by gas engines.

The Eagle Horseshoe Company, of South Milwaukee, Wis., has completed arrangements for the enlargement of its plant. The company will erect new rolling-mill buildings and equip them with the necessary engines, rolls and furnaces. The new buildings will be 50x160 feet and 40x96 feet in size and will contain a new 10-inch rolling train of the most modern make, with a capacity of 60 tons of finished iron per day; a Payne Corliss engine of 3,000 horse-power, two 200 horse-power boilers, a 250 horse-power Berryman heater, two 6½x13-foot heating furnaces, pumps, blowers, shears, cooling beds, dynamos and all necessary equipment for a modern merchant mill.

New Catalogs.

We have received from J. W. Cregar, Philadelphia, Pa., circular illustrating and describing the Simplex lathe center grinder. The circular is 5½x8 inches.

Jas. Clark, Jr., & Co., Louisville, Ky., send us catalog describing and illustrating electrically driven machine tools, including drills, tool grinders, etc. The catalog is standard size, 6x9 inches.

The Atwood Power & Speed Gage Company, of 95 Liberty street, New York, send us a catalog of their power gage and mean effective pressure indicators for steam engines. The size is 6¾x10 inches, 14 pages.

We are in receipt of a catalog and circular of information of the department of science and technology of Pratt Institute of Brooklyn. This institution has had a remarkable growth, having enrolled over 2,900 students during the past year. Sixteen pages, 6x9 inches.

F. W. Emerson Manufacturing Company, Rochester, N. Y., send us catalog in which is illustrated and described a full line of furniture used in drawing rooms. The variety of tables illustrated is quite large, and, in addition, blueprinting frames, drawing-board cabinets, etc., are described. The catalog is standard size, 6x9 inches.

The Ingersoll-Sergeant Drill Company has sent us a copy of air-compressor catalog No. 33. This contains illustrations and descriptions of various compressor plants. In addition the catalog contains a number of valuable tables which should prove useful to those engaged in air-compressor work. The catalog is nicely printed and contains 105 6x9-inch, standard size, pages.

The mechanical department of the Kansas State Agricultural College, Manhattan, Kansas, sends us a catalog giving the course of study and other particulars of the work in mechanical engineering. It is in the shops of this institution that the apprenticeship system described by Prof. O. P. Hood, in our issue of August 24, is in use. Fifteen pages, 6x9 inches.

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Your work is undoubtedly often delayed if you are using emery wheels for your grinding.

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wheels, when properly selected, never require dressing, because, on account of their extreme hardness and brittleness, they wear away evenly, and at the same time keep the cutting surface fresh and sharp.

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STRIPPING PLATE MACHINES, PORTABLE AIR POWER MACHINES, using wood or metal split patterns, without stripping plates.
WRITE FOR INFORMATION.
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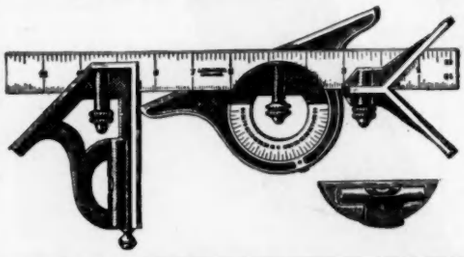

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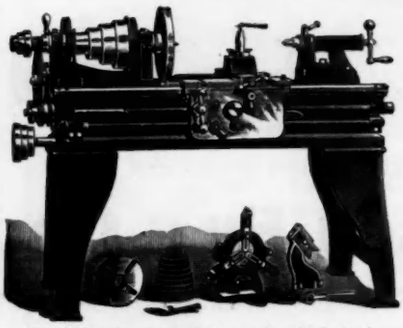
Heat and Heat-Engines. A Study of the Principles which Underlie the Mechanical Engineering of a Power Plant. By FREDERICK REMSEN HUTTON, E.M., Ph.D., Professor of Mechanical Engineering at Columbia University. 559 pages. 8vo, cloth, $5.00.
JOHN WILEY & SONS, 53 E. 10th St., New York City.



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